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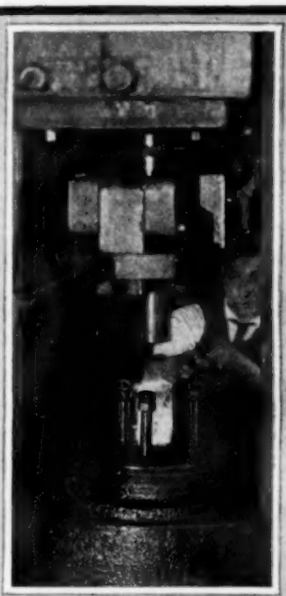


Improved Methods of Hollow Forging

By S. A. Hand,
ASSOCIATE EDITOR, AMERICAN MACHINIST

While the product described in this article is an essential one and relates to war, the process of manufacture can be applied to many articles for use in times of peace. The methods described were used in France in making forgings for the famous 75-mm. shell. They have been adapted to American practice and have been found more economical than the methods formerly used in American plants.

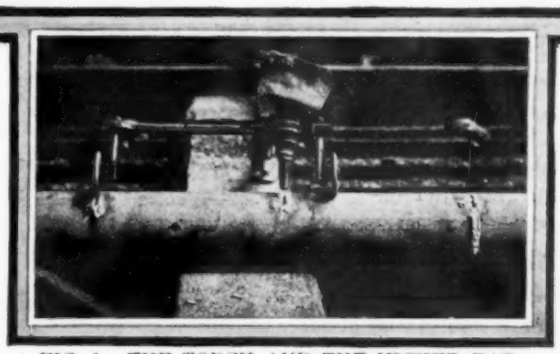


FIG. 1. THE TORCH AND THE NICKED BAR

IN THE machining of shells there has been much waste of time and material owing to lack of concentricity in the forgings. The trouble starts in the first forging operation known as piercing, and if the hole and the exterior are not made concentric in this operation no amount of work in the succeeding forging operations will make them concentric. Working to eliminate this trouble the Worthington Pump and Machinery Corporation has adapted at its Hazleton, Penn., plant a French process for forging 75-mm. shells, the result of which is a product several pounds lighter than formerly and requiring much less work in machining.

The billets from which the forgings are made are broken from bars of shell steel $2\frac{83}{64}$ in. in diameter. All bars bearing the same heat number are kept in a separate pile, the practice at this plant being to work continuously on material bearing one heat number until it is all used. The first operation is nicking the bars so they can be broken into billets of the proper length. This is done with an oxy-acetylene torch mounted on two copper wheels so spaced that one wheel acts as a length gage for the distance between nicks. The torch and nicked bar are shown in Fig. 1 and the details of the mounting are shown in Fig. 2. The bar at the position of the nick is preheated for about two seconds by the acetylene flame, combined with a small amount of oxygen, after which the full amount of oxgen is turned on, producing a flame of intense heat that locally fuses the steel.

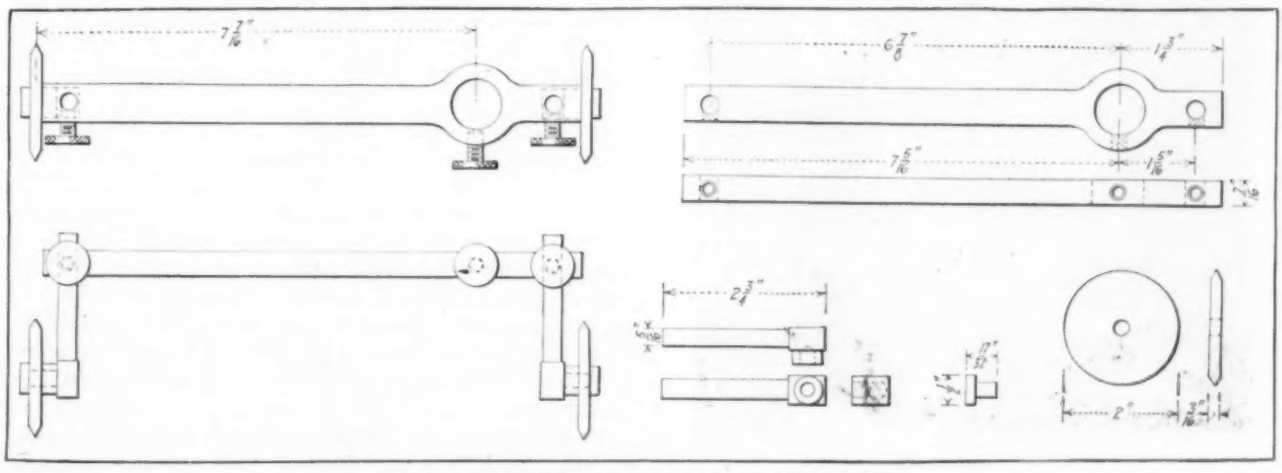


FIG. 2. DETAILS OF THE TORCH MOUNTING

During the application of the intense flame the torch is moved about ½ in. transversely, resulting in a hollow spot about ½ in. long and $\frac{3}{16}$ in. deep. No further marking or measuring is necessary, as placing one wheel of the torch mount in the preceding nick brings the

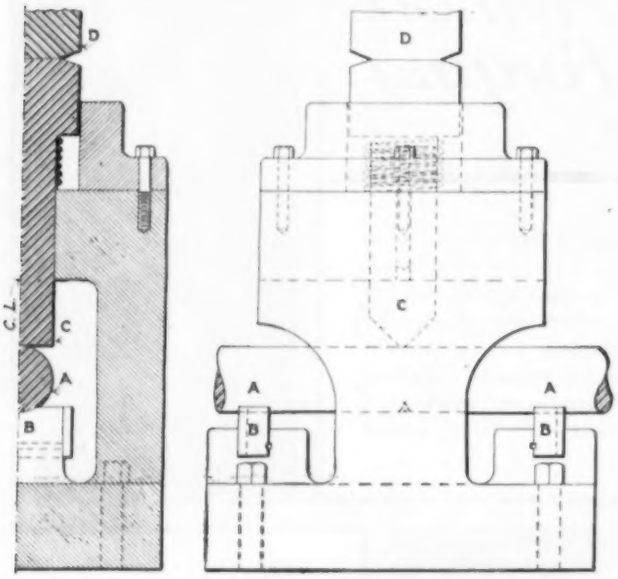


FIG. 3. THE BREAKING DIES

nozzle in the proper position to make the next one. One operator can nick about 7000 billets in eight hours.

The cost of the gases is about $1.50 per 1000 nicks.

Breaking the Bars

After nicking, the bars are passed to the first breaking press where they are broken into lengths of about five billets. The press is equipped with a subpress having two hardened supports, or anvils, on which the bar rests, and a breaking punch that is normally held away from the bar by a spring as shown in Fig. 3. *A* is the bar to be broken, *B* the anvils, *C* the breaking punch and *D* a hardened piece on the press ram. Fig. 4 shows the subpress as mounted in the press proper.

When the press ram descends it pushes the breaking punch into contact with the bar, and a continued downward motion of ¼ in. further is all that is necessary to break the bar.

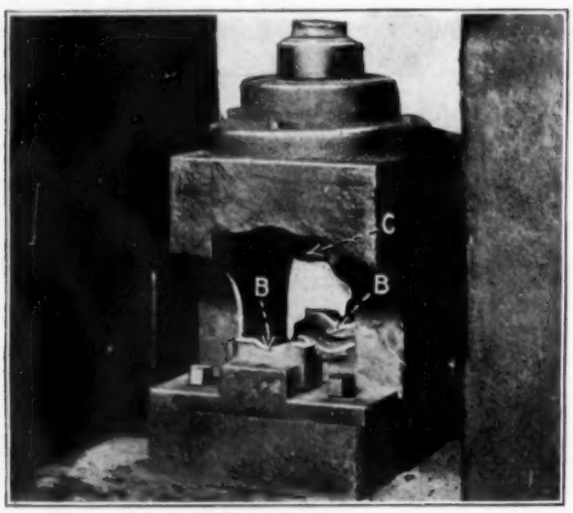


FIG. 4. THE SUBPRESS

The theory of this process is that nicking the bar by the torch flame disrupts the molecular construction of the steel and sets up unequal internal stresses at the cross-section where it is nicked so that it can be broken with comparative ease. Experiments have shown that the length, width and depth of the nick have not much to do with the breaking except in the amount of power required. This process is the subject of a French patent.

Differences in temperature alter the conditions of breaking to some extent. In hot weather there is a tendency for the parts to stick together, while in cold weather they will fly apart for a considerable distance.

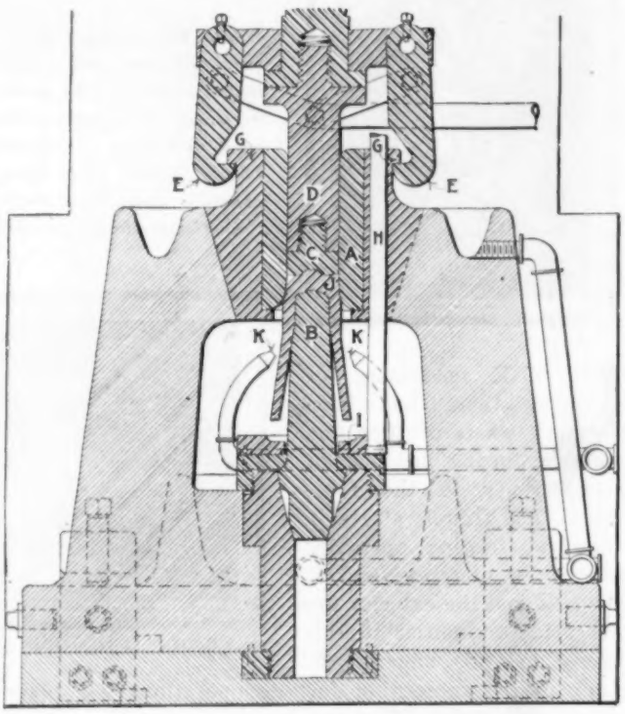


FIG. 5. SETUP OF THE PIERCING PRESS

From the first breaking press the short bars are taken to the second breaking press where the billets are broken off singly. This press and equipment are the same as used for the first breaking.

SEQUENCE OF OPERATIONS

1. Nick with oxyacetylene torch.
2. Break into five-billet lengths.
3. Break into billet lengths.
4. Heat to 2000-2200 deg. Fahrenheit.
5. Pierce.
6. Hot-draw.
7. Anneal.
8. Pickle, wash and scrub.
9. Cold-draw.

The billets, which are $7\frac{7}{16}$ in. long and weigh from 14 lb. 11 oz. to 15 lb., are passed to gravity conveyors and are there inspected for pipes, segregations, surface defects and porosity of metal. Segregations that are hardly noticeable are apt to show up in the pierced billet as cracks ranging from ¼ in. wide to a complete split. If the segregations are small they are cut out with an air chisel.

Passing from the inspectors down the gravity conveyors, the billets are charged into oil-fired furnaces

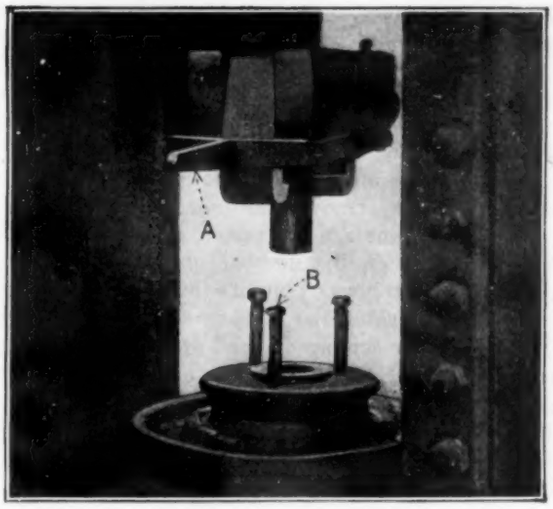


FIG. 6. THE GRAB HOOKS

fitted with iron-pipe preheating runways about 20 ft. long, through which they are gradually pushed into the main heating pit. There they are heated to from 2000 deg. to 2200 deg. Fahrenheit.

The pyrometers for controlling the furnaces automatically operate electric lights of three colors—red, signifying too high heat; white, the proper heat, and blue, too low heat. These lights can be seen from all control points of the furnace, so that the man in charge can tell the heat conditions without reading the pyrometers. Recording pyrometers keep daily records of the heat conditions by means of graphic charts.

The oil used for fuel is ordinary crude petroleum, and is fed to the burners by an air blast at a mercury pressure of from 6 in. to 9 inches.

Each furnace will hold 100 billets, and 20 min. are required to bring them to the proper temperature.

Piercing the Billets

From the furnaces the billets are transferred to the piercing press. Here they are forced through a sleeve, or matrix, and down over a stationary inverted piercing punch. Fig. 5 shows the setup on the press, in which *A* is the matrix, *B* the punch, *C* the base-forming die and *D* the plunger attached to the press ram. Toward the end of the downward motion of the ram the grab hooks *E* engage in the rim of the matrix holder at *G*, so that the return stroke lifts the matrix holder from its conical seat. In rising, the upper face of the matrix holder comes in contact with the nuts on the bolts *H* which are attached to the washer *I*, carrying it up so that it strips the pierced billet *J* from the punch. Cold-water jets are provided at *K* for cooling the punch and matrix.

Before piercing the next shell it is necessary for the press to make an idle stroke to reseat the matrix holder. The grab hooks are then released by the lever *A*, shown in Fig. 6, where the three bolts that operate the stripper may be seen at *B*.

Salvaging Cracked Billets

Should the pierced billet show longitudinal surface seams it is placed on a horn, or stake, and the seam opened out by a swedge so that the sides form an included angle of about 90 deg. The subsequent procees of hot-drawing irons out the seam. If it was attempted to close the seam instead of opening it the result would be a pipe after hot-drawing.

The wear on the punches and matrices both from the work and the heat is very great and considerable experimenting has been done not only to find the best material from which to make them but the method of heat treatment that will insure the longest service. At present a chrome-vanadium steel known as La Belle hot-work steel is used for the punches. They are heated in a muffle furnace to 1550 deg. F. and quenched in oil, reheated to 1100 deg. F. and again quenched in oil.

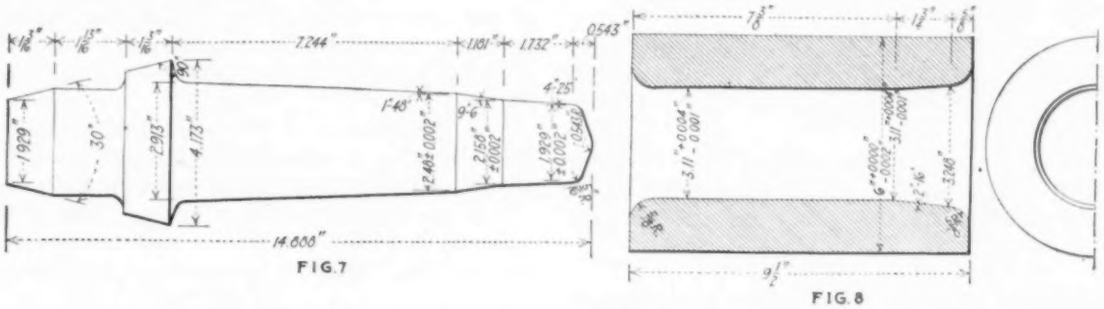


FIG. 7

FIG. 8

FIGS. 7 AND 8. THE PIERCING PUNCH AND THE MATRIX

From the performance of the punches it has been determined that when made of steel that is comparatively soft and tough they work better than if made of hard steel. Experiments have been made with chilled cast-

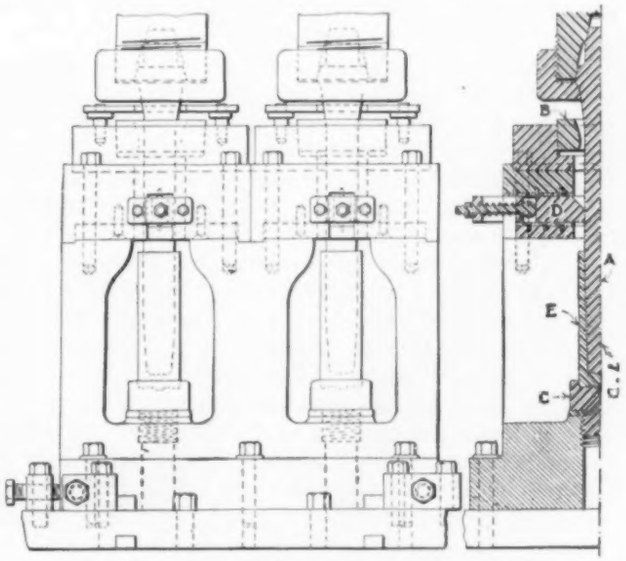
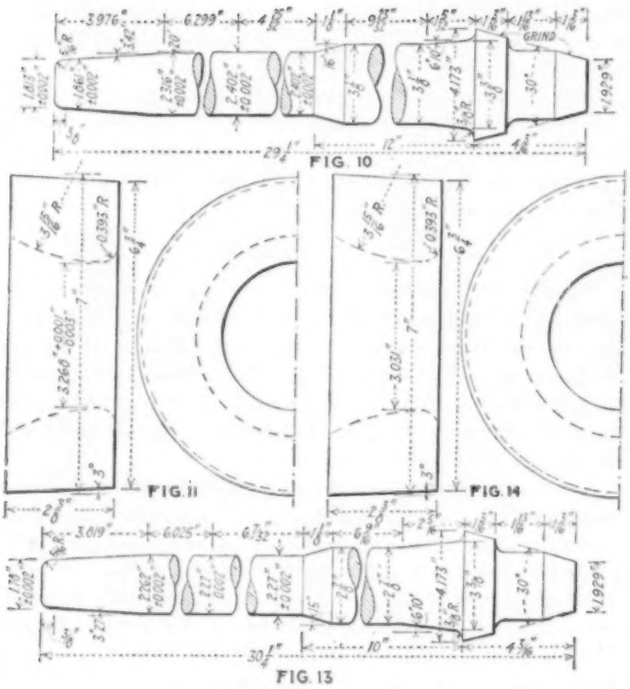


FIG. 9. SETUP OF HOT-DRAWING PRESS



FIGS. 10, 11, 13 and 14. HOT AND COLD DRAWING TOOLS
Fig. 10—Hot-Drawing Punch. Fig. 11—Hot-Drawing Die. Fig. 13—Cold-Drawing Punch. Fig. 14—Cold-Drawing Die

iron punches, but the statement above that a soft, tough material is best readily explains why a hard and brittle metal such as chilled cast iron will not stand up under the strain.

Pack-hardened machine-steel punches have also been tried, but the hardened skin was soon destroyed by the heat from the billets, and they soon commenced to upset.

Life of Punches and Matrices

Punches made of chilled cast-iron and pack-hardened machine-steel have pierced about 200 billets before breaking down.

Chrome-vanadium steel punches, heat-treated as before mentioned, have pierced as many as 1700 billets without regrinding, and their total life is from 3000 to 5000 billets. The matrices are made of an alloy of manganese and cast iron, known as Adamite, and have a life of 1000 to 1500 pierced billets.

While the punch and matrix absorb a great deal of heat from the hot billets—and they work better when heated to a certain temperature—they must not be allowed to get red hot, so water jets are used to cool them. To prevent the billets from sticking to either the matrix or the punch these parts are doped with a mixture of graphite and a special press grease.

In piercing billets certain fixed distances must be kept between the wearable parts of the piercing apparatus, and the amount or wear must be constantly checked. For instance, the end of the punch either wears away or is permanently compressed about $\frac{1}{16}$ in. for every 1000 billets pierced so that it becomes necessary to lower the position of the press ram at stated intervals to compensate for this wear. Readjustment of the ram must be done with care, for if the billet is driven down too far on the punch the walls will be too thin, and if not far enough they will be too thick. If the latter condition prevails too much power will be required in the next operation of hot drawing, besides there is always the ever-present danger of the forging being torn in two.

The crew for operating one piercing press consists of four men. One man cleans the hot billet from scale; one man picks up the billet, cools one end slightly by dripping in water and places it, hottest end down, in the matrix; one man removes the pierced billets from the press, dopes the matrix and punch, operates the cooling jets, keeps tally on the number of billets pierced and operates the grab hooks that lift the matrix holder; the fourth man operates the press.

The reason for cooling one end of the billet is to prevent the metal from flowing up and forming a flash around the base-forming die.

Details of the punch and matrix are shown in Figs. 7 and 8.

Hot-Drawing

After piercing, the billet is passed without reheating to the hot-drawing press where it is pushed base first through a die by a punch that enters the hole already made. In this operation the forging is lengthened about $1\frac{1}{4}$ in., the hole reduced about $\frac{5}{16}$ in. in diameter and the walls thinned about $\frac{1}{8}$ inch.

The end of the punch is flat instead of slightly pointed, as in the piercing operation, and the contour of the base re-forming die is such that the tit on the base is compressed in its length so as to force the metal at the bottom of the hole against the flat end of the punch.

The temperature of the pierced billet must not be over 1300 deg. F. when passed through the hot-drawing process lest the forging pull apart in the process.

The punches for hot-drawing are made of the same material and receive the same heat treatment as those for piercing. The dies are made of Adamite. The die

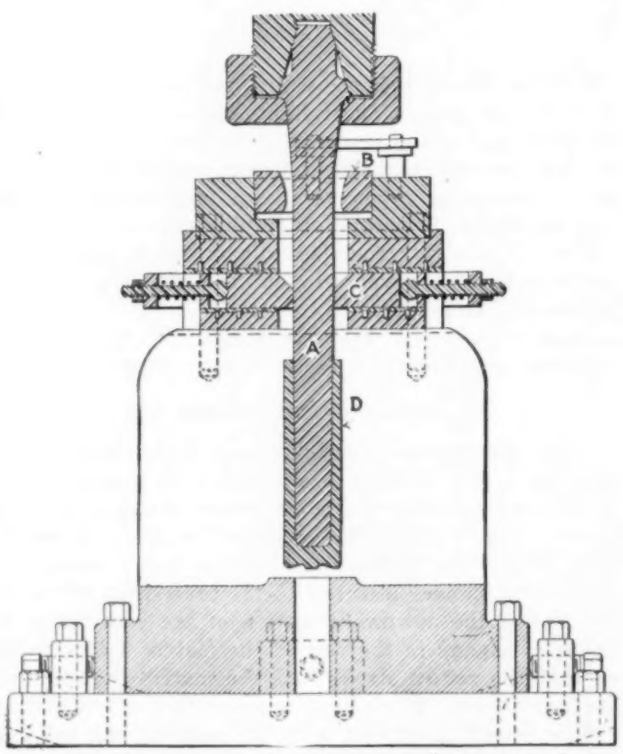
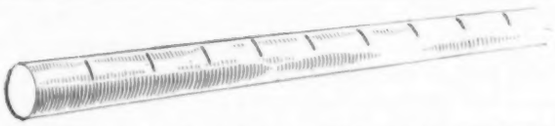


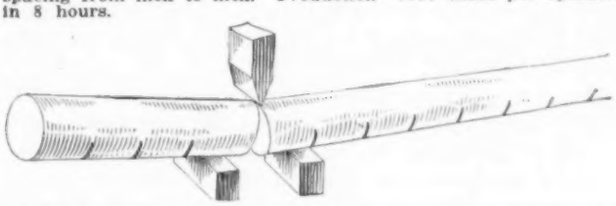
FIG. 12. SETUP OF COLD-DRAWING PRESS

for re-forming the base is made of machinery steel and has provision for the insertion of steel stamps for marking a code representing the heat number.

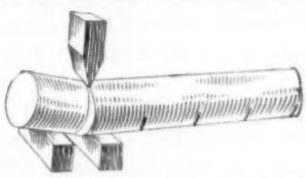
The punches and dies are doped with the same lubri-



Transformation for Operation 1.—Nick. Tools—Oxyacetylene torch mounted on small copper wheels; one wheel arranged for spacing from nick to nick. Production—7000 nicks per operator in 8 hours.

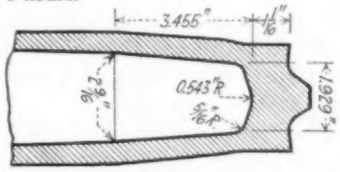


Transformation for Operation 2.—Break in five-billet lengths. Machine—No. 87 Bliss press driven by a 15-hp. motor. Tools—Subpress with breaking punch and two work supports, or anvils. Number of Operators—Three. Production—7000 per press in 8 hours. Note—Illustration shows only four pieces in billet.

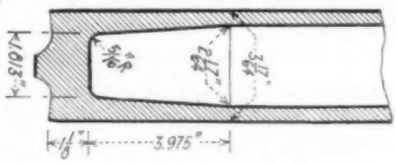


Transformation for Operation 3.—Break in single billets. Machine—No. 87 Bliss press driven by a 15-hp. motor. Tools—Same as previous operation. Production—7000 per press in 8 hours.

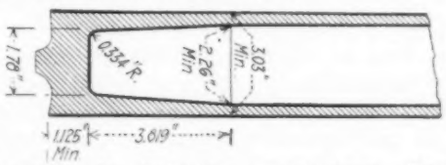
Transformation for Operation 4.—Heat. Equipment—Ten American oil-burning furnaces; pyrometers. Production—1200 per furnace in 8 hours.



Transformation for Operation 5.—Pierce. Machine—No. 78½ Bliss special press, 16-in. stroke, driven by a 30-hp. motor. Equipment—Punch, matrix and stripper; two water jets for cooling punch. Number of Operators—Four. Lubricant—Graphite mixed with a special press grease. Production—2300 per press in 8 hours.



Transformation for Operation 6.—Hot-draw. Machine—No. 78½ Bliss special press, 32-in. stroke, driven by 40-hp. motor. Number of Operators—Four. Equipment—Duplicate punches and dies used alternately; base-forming tools, with provision for insertion of steel stamps for stamping the heat number on the forging; stripper. Lubricant—Graphite mixed with special press grease. Production—2000 per press in 8 hours.



Transformation for Operation 9.—Cold-draw. Machine—No. 78½ Bliss special press, 32-in. stroke, driven by a 40-hp. motor. Equipment—Punch, die and stripper. Lubricant—Lubro. Production—3000 per press in 8 hours.

cant as used in piercing. The life of the punches is about 1000 forgings, and of the dies from 400 to 700.

The setup of the press is shown in Fig. 9, in which it will be seen that there are two punches and dies set side

FIG. 15. THE BILLET AND THE FORGINGS

by side. These are used alternately so as to allow time for cooling. Referring to the sectional view, *A* is the punch, *B* the die, *C* the base re-forming die, *D* the spring-actuated stripper and *E* the forging that has just been drawn. Details of the punch and die are shown in Figs. 10 and 11.

Annealing and Pickling

From the hot-drawing press the forgings are tossed to the annealing pits near by. Here they are packed with fine coke and allowed to cool slowly. When cold they are pickled to remove the scale. The pickling is done in a hot solution of Eddes compound (sodium bisulphide) and commonly called niter cake. It is a by-product from the manufacture of nitric acid. About 1 lb. of niter cake is used for each forging to be pickled. The strength of the solution, which is used at a temperature of 175 deg. F., is 1 to 12.

About 1½ hours are required for thorough pickling, after which the forgings are washed in cold water and the scale brushed off. After pickling one batch of forgings the bath can be used for another batch by adding 50 per cent. of the original amount of niter cake; a third batch can be pickled in the same way, after which the vat should be emptied and the residue cleaned.

The forgings are now ready for the final operation, which is cold-drawing, and is a repetition of the hot-

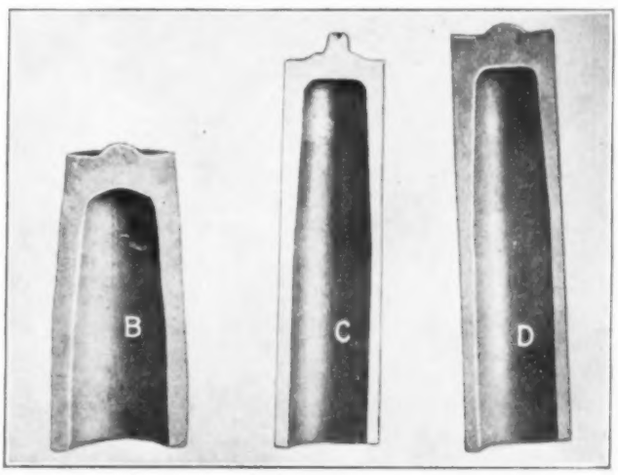


FIG. 16. THE FORGINGS CUT OPEN

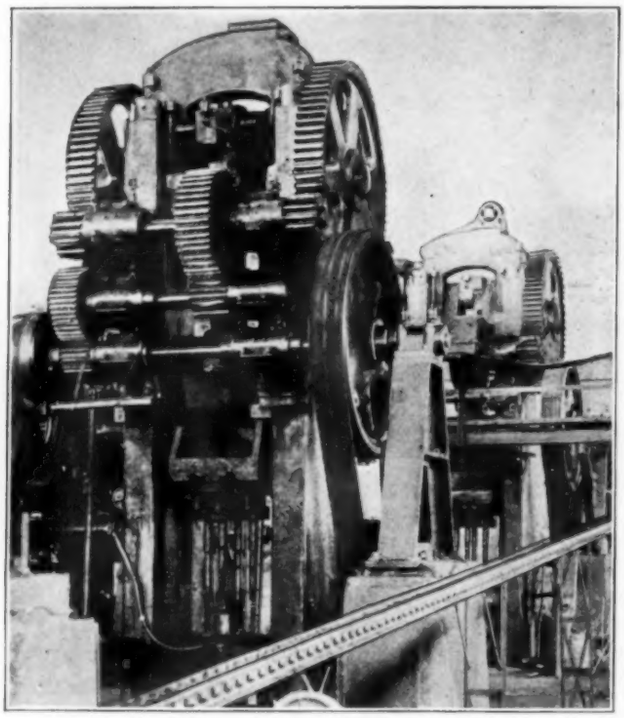


FIG. 17. PRESS FOR FINISH HOT-DRAWING

drawing process with the exception that the forgings are not heated.

This operation adds about 2 in. to the length of the forging, reduces it in diameter about $\frac{1}{4}$ in., reduces the diameter of the hole about $\frac{1}{64}$ and thins the walls 7/64 in., representing a displacement of more than 4 cu.in. of metal.

Both the punches and dies are made of Crescent steel. The punches are heated in a muffle furnace to 1450 deg. F. and quenched in brine. They are then drawn to 400 deg. F. in an oil bath and quenched in oil.

One of the secrets of successful cold-drawing is in the hardening of the dies. This is done by quenching the walls of the hole only by a stream or jet of water, leaving the rest of the die soft. A drawing die intended for hard work, if hardened all over, is apt to break at the first attempt to draw through it.

The punches have an average life of from 3000 to 7000 forgings and the dies about 2000. The dope used on the punches and dies is a compound known as Lubro.

The setup of the press for cold-drawing is shown in Fig. 12, in which *A* is the punch, *B* the die, *C* the stripper and *D* the cold-drawn forging. Details of the punches and dies are shown in Figs. 13 and 14.

Cold-drawing gives the least trouble of any of the operations, and if the forgings are supplied in sufficient quantity the press can be kept running continuously and 2000 forgings a press a day of eight hours can be cold-drawn with ease.

The forgings come from the cold-drawing press with the holes clean and to size, so that the only tooling required is deepening the holes slightly in order to remove the nonhomogeneous metal that is naturally forced to the bottom by the punches in piercing and hot-drawing. The outside of the forging, while bright, has some longitudinal scores on its surface.

Forgings made by this process weigh from 5 to 7 lb. less than those formerly bought in the open market, and require much less machine work than those made by other processes.

The billet is shown at *A*, Fig. 15, while *B* is a pierced billet, *C* is a hot forging and *D* is cold-drawn. Fig. 16 shows the forgings cut open and designated by the same reference letters used in Fig. 15.

Finish Hot-Drawing

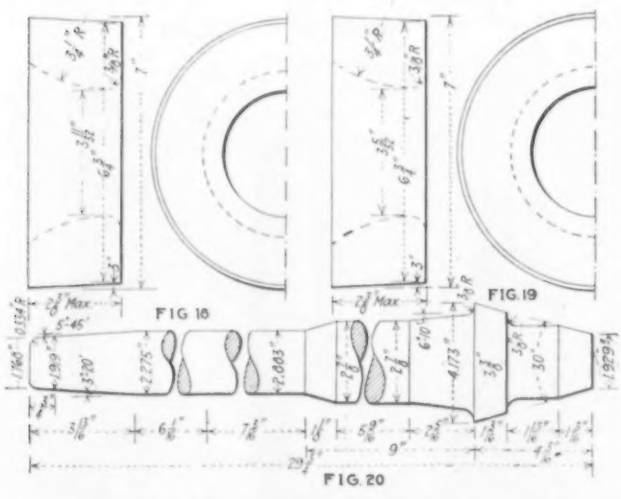
The Worthington Pump and Machinery Corporation has carried its experiments still further and has developed a hot-forging process that surpasses the cold-drawing process just described in that it cuts out the operations of annealing and pickling.

In this process the pierced billet is passed through two hot-drawing operations without reheating. There are two methods of doing this in use at the present time.

The first is by passing the pierced billet through two successive hot-drawing operations by means of a press equipped with two dies set side by side and drawing the pierced billet first through one die and then through the other. Four punches are mounted on a turntable on the press ram as shown in Fig. 17, and while two are in use alternately the other two are in dipped tanks of water at each stroke of the press. At the completion of every fifth or sixth forging the press is stopped and the turntable turned one-quarter way around, bringing the two idle punches into use and allowing the hot ones to be cooled in the tanks of water. Passing the pierced billet through the first die produces a forging about the same as in the hot-drawing previous to the cold-drawing operation, while the second die leaves it about the same as the cold-drawing die except that the surface is a blue-black of high luster like that of a bar of tool steel.

The second and improved method is to pass the pierced billet through two dies set one above the other, so that the operation is completed at one stroke of the press. By this process operations 7, 8 and 9 are eliminated.

The two dies are shown in Figs. 18 and 19 and the punch in Fig. 20.



FIGS. 18 TO 20. FINISH HOT-DRAWING TOOLS

Fig. 18—Upper Die for Finish Hot-Drawing. Fig. 19—Lower Die for Finish Hot-Drawing. Fig. 20—Punch for Finish Hot-Drawing.

WAR-TIME REPAIRS IN THE NAVY

By FRANK A. STANLEY

V. Boring and Lining Operations

This article explains the principal features of the simple and thorough system for taking care of the many jobs handled by the repair ship. Relining a set of connecting-rod brasses is also described, together with details connected with the necessary boring of the lining. The method of setting up the work on the horizontal boring machine is described and illustrated.

THE work handled for the fleet by the repair ships is taken care of by a simple system carried out in the repair officer's headquarters on board the train flagship "Vestal." Thousands of orders for work of all kinds come to this ship every month, and the necessary job orders are here issued to the different departments of the ship by the repair officer and his yeoman assistant. When the part repaired or the new part made is finished and sent back to the ship originating the work all records covering the job are put in an envelope and filed for reference in a steel cabinet with the records for each ship in a special drawer.

General Instructions

As many of the ships are away from the naval base for days or weeks at a time it is important that full instructions be given with each job to prevent serious delays in completing the work. To eliminate misunderstandings in connection with drawings, sketches, etc., the instructions, Fig. 42, are issued by the train commander.

The Original Job Orders

It is the intention that such repairs as can be attended to by a vessel's own mechanics be handled in the shops on that ship. But as the machine shops on men-of-war are limited in space and equipment there is a large share of work that can be done to best advantage by the regular repair ships, especially if the job requires the attention of mechanics of special experience or skill.

The requests for repairs from ships are made on a standard form, Fig. 43, which is sent to the train commander, and if two repair ships are present at the base he assigns the work to the ship best prepared at the moment for handling the repairs. This is usually determined by means of weekly reports from the repair ships showing the number of mechanics available, the number of days' work already on hand, and the percentage of urgent work. The repair officer determines the plan of handling the work and lays out the schedule on the loose-leaf form, Fig. 44, copies of which are sent to each shop having part of the work to look after and to the supply officer as a record of material charges. The reverse of the form is shown in Fig. 45.

TABLE I. UNITED STATES SHIP "VESTAL"

Weekly Report of Work
Week ending July July 14, 1917

Job Order and Ship	Specifications	Remarks
	Completed Jobs	
3759—Alabama	Manufacture one eccentric strap	Complete and Delivered
3674—Arizona	Manufacture six ice-making cams	Complete
3453—Arkansas	Manufacture following items: 1. Twelve diffuser cones, C. I 2. Twelve air cones, C. I 3. Twelve false furnace doors, C. I 4. Twelve diffuser sleeves, C. I 5. Two ring castings 6. One ring casting	Complete and Delivered
3753	Repair following items: 1. Straighten one shaft, 50-ft. steamer 2. Straighten and repair one shaft, 50-ft. steamer	Complete and Delivered
3814—	Repair one telescope, MK. XV-6 No. 25	Complete and Delivered
3806—Bridge	Overhaul one comparing watch, No. 343	Complete

When the work is completed and sent back to the ship ordering it all the records pertaining to it are placed in a large envelope, which is placed on file in a compartment devoted to this one ship, so that by referring to a special drawer all of the records of work handled for any ship are located at once.

The repair officer turns in to the train commander a

File 23

UNITED STATES ATLANTIC FLEET
TRAIN, U. S. S. VESTAL, Flagship
BASE TWO 18 OCTOBER 1917

FROM: Commander Train
TO: Atlantic Fleet

ON TRAIN SERVICE.

Subject: Requests for Repairs.

1. Requests for repairs have been received in which the accompanying sketches were marked **"dimension for pattern etc"** when it is evident the dimensions given were for the finished product Sketches accompanying requests often have incomplete dimensions, views and are sometimes indefinite

2. In order to avoid the necessity for further correspondence, signalling and the resulting delay caused thereby, the Train Commander requests that ships submitting sketches be guided by the following:

1. Dimensions to be of the finished product
2. All surfaces to be marked "F" which are to have machine finish since all others will merely have the finish from the mold or original surface or possibly a rough file finish, etc
3. All sketches contain two or more views of the work
4. Write all necessary dimensions on sketch and do not trust to scaling a drawing
5. Material desired should **always** be stated, or broken parts furnished Similar parts have been received from different ships, made of various materials
6. Specify on the drawing the number of pieces required
7. Make the sketch sufficiently large so that all details may be understood
8. State on drawing the name of ship and number and date of letter referring to same
9. Sample or broken parts should always be furnished when possible, whether or not sketches or drawings are furnished This expedites work

W L. RODGERS

COPIES:

Commander-in-Chief	10
Combattor Two	90
Combattor One	90
Comdr. Destroyer Detachment	50
Comdr. Submarine Force	40
Comdr. Mine Force	50
Comdr. Patrol Force	25
TRAIN SHIPS	30

FIG. 42. GENERAL INSTRUCTIONS

weekly report of work on hand in the shops, so that as new work comes in this report serves as a guide for the turning over of the job to one repair ship or the other according to the amount of uncompleted work already on hand and the number of men available in various shop departments.

These reports constitute an up-to-date record of the ship's force of mechanics and the amount of work still uncompleted in each shop.

The "Vestal" has a complete electrical shop in which a great variety of work is handled. To facilitate the rapid completion of jobs of this character the form

Plan Form 20
Printed in Duplicate.

U. S. S. NORTH CAROLINA
Base Two
25 June 1917

FROM: C. O. NORTH CAROLINA
TO: Commander Train
OR: C. O. (when only one repair ship is present)

1. I request the following {urgent / } {repairs / } be made coming under the cognizance of the Bureau of Construction & Repair
(In this space give a full description of the work requested.)

Item 1:- Manufacture one (1) piston and three (3) rings for the compressed air plant of the launching device; cast and prepare for installation.

This work is beyond the capacity of the ship's force.

2. The U. S. S. NORTH CAROLINA will furnish blue print (sketch) (item) and broken parts (patterns) (items etc.) to assist in this work

3. Accompanied herewith is blue print. (drawing) (sketch) (broken parts) (patterns).

4. I request this work be completed by as soon as possible.

5. This work is beyond the capacity of the ship's force.

FROM Commander Train.
TO: C. O.

Forwarded

FIG. 43. JOB ORDER FORM

shown in Fig. 46 is filled out on board the ship requiring the work, giving the essential information for the benefit of the electricians on the repair ship.

TABLE II. UNITED STATES SHIP "VESTAL"

Weekly Report of Work
Week ending July 14, 1917

Job Order and Ship	Specifications	Remarks
	Uncompleted Jobs	
3838—Sea Gull	1. Repair broken plank, starboard quarter.... 2. Repair leaky window frame aft, and leaky ventilator..... 3. Fit hinged band at break in mast.....	65 per Cent. Complete
3833—Solace	Repair following items: 1. Three armatures, watertight door system 2. Three field coils, watertight door system.. 3. Two solenoids, watertight door system...	60 per Cent. Complete
3776—South Carolina	Overhaul and clean one 3-in. telescope, Mk. XI-8, No. 3763.....	0 per Cent. Complete
3819—South Carolina	1. Renew shaft for extractor, laundry..... 2. Repair or renew bottom of extractor.....	75 per Cent. Complete
3429—Texas	Repair and overhaul following items: 1. Three OOD glasses, Nos. 1872, 2420, 2365..... 2. One boat clock, No. 433..... 3. One clock, No. 121.....	90 per Cent. Complete

A weekly report of work in detail is made out in the repair office, showing the jobs completed during the week, and the uncompleted jobs with percentage of

U. S. S. VESTAL
Date 6-28-17 1917
Aux J. O. 3758-D
For CAR U.S.S. NORTH CAROLINA

SPECIFICATIONS.
Manufacture one (1) piston, and set of rings, air plant of launching device, as per sample and blue print No. A-389.

PLAN OF WORK.
Shop "P"-Pattern, piston & ring.
Shop "F"-Cast, C.I. 1 off each pattern.
Shop "S"-Weld old piston for spare.
Shop "M"-Machine - E xecute.

Material used in shop has been charged against the job.

USN. Officer in Charge
Date Commenced
Date Completed

NOTES.

NAME	RATE	TOTAL HOURS

FIGS. 44 AND 45. WORK PLAN SHEET AND MATERIAL FORM FOR SUPPLY OFFICER

work complete given in the last column. Two sheets from a typical weekly report are shown in Tables I and II.

An almost endless number of jobs are handled in the optical and watch shops, as will be seen upon examination of the monthly report in Table III. Two views of the optical shops are shown in Figs. 47 and 48. The first is the shop where large range finders, binoculars, etc., are overhauled; a 12-ft. range finder will be seen on the stands in the center of the room. The view in Fig. 48 shows a corner of the instrument shop on the deck below, where a complete machine equipment is installed.

A quarterly report is made out for the various naval bureaus, covering details of all work handled for different ships and classified by bureau of navigation, construction and repair, ordnance, steam engineering and so on. This report covers thousands of items carried

U. S. S. VESTAL,

FROM: Commanding Officer.
TO: Commanding Officer, U. S. S.....
SUBJECT: Electrical Material; Request information of.
Reference: (a)

1. Please furnish answers to questions checked on list below. This information is necessary in order to properly carry out repairs on.....

Series, shunt or compound.....
Speed, constant or variable.....
Duty, continuous or intermittent.....
H. P..... R. P. M..... Volts.....
No. of poles.....
No. of field coils per pole.....
Diameter of bore (exactly).....
No. of brush stems.....
Brush stem extends over winding { Yes / No ——— Inches.....
Brushes, fixed or shift..... degrees.....
Commutator trouble.....
Armature trouble.....
Temperature in operation (Normal or excessive).....
Wear of bearings; commutator or back end.....
Armature rest on pole pieces.....
What repairs attempted.....
Distance from coils to bearing head or frame.....
If stripped, send sample coil.....

FIG. 46. BLANK FORM FOR ELECTRICAL DATA

through the different shops on the repair ship and is nothing short of a revelation to one unaccustomed to the variety and quantity of work regularly accomplished by the ship's repair crew.

Relining Connecting-Rod Brasses

A set of four crankpin brasses from the connecting-rods of the main engines of one of the battleships was sent to the repair ship "Vestal" to have their bearing surfaces renewed by remetaling with antifriction metal.

The brasses as they appeared on the "Vestal's" deck are shown in Fig. 49. Their dimensions are given in Fig. 50, which shows the rod end with the brasses in place.

The old worn metal lining was removed by melting, as in Fig. 51. For this operation one brass at a time was suspended over a crucible by means of the chain hoist in the gallery and a kerosene torch applied as

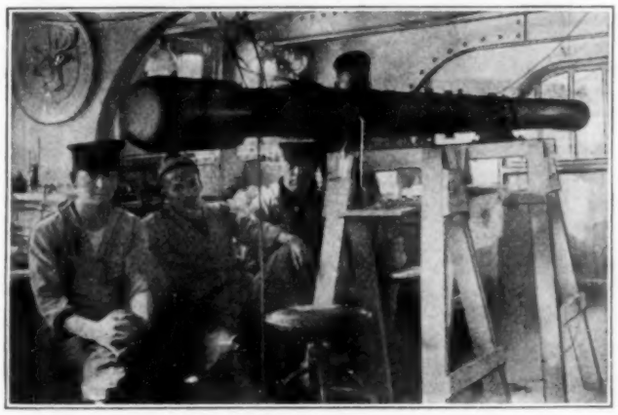


FIG. 47. RANGE FINDER IN OPTICAL SHOP

illustrated to flow the metal. The flame under air pressure is played against the old lining, and in a few moments the metal flowed out freely into the receptacle below.

Melting the metal for pouring the new surfaces is accomplished as shown in Fig. 52. A portable oil heater is used, with the melting pot suspended directly over the top of the apparatus. The heater is made up of a cylindrical shell of $\frac{1}{2}$-in. boiler plate 15 in. outside diameter and mounted on a platform with four wheels at the corners so that it may be moved as readily as an

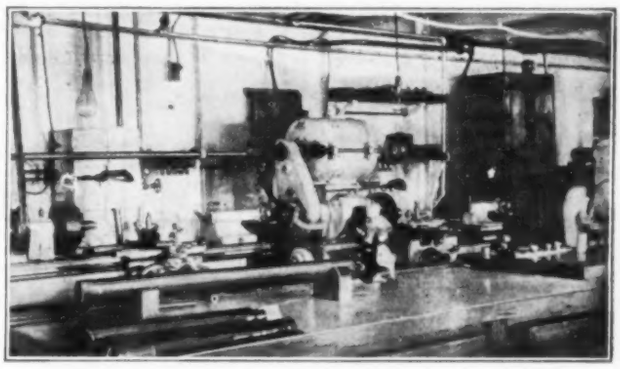


FIG. 48. GENERAL VIEW IN OPTICAL SHOP

ordinary truck. The two pipes at the bottom are for the oil and air supply. The interior of the steel shell is lined with 2 in. of fire clay, and there is a cast-iron pot, or liner, inside of this, forming the central chamber in the heater.

Crude oil is used for fuel, being supplied from a portable tank. The air pressure is regulated by the valve at the heater base.

In setting up the work for pouring no babbitting arbors are used and the sole special device required consists of a sheet of 20-gage galvanized iron. When it is considered that each brass is poured with nearly 100 lb. of babbitt and that the area of the surface poured equals something like 450 sq.in., the use of a thin sheet

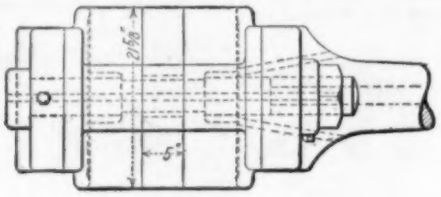
FIG. 49. THE BRASSES TO BE RELINED

of metal in place of a heavy arbor of some kind seems a rather doubtful procedure. As a matter of fact the method is a most satisfactory one and is regularly followed in navy practic

Two of the brasses are poured at once, so that two sheets for the babbitting forms are used, as shown in Fig. 53. The job is set up as indicated in the illustration. The work to be relined is shown at *A*, and the sheet-metal forms at *B*. The brasses as they stand upright are $21\frac{3}{8}$ in., and the sheet-pouring forms are made about 2 in. higher. The forms are made to allow for a thickness of metal of 1 in. to be run into the brasses. The brasses when secured in place at the end of the connecting-rod are spaced apart by lining

blocks, so that the halves to be poured are not full half circles.

The two halves as set up for the pouring of the lining are spaced by two strips of wood, *C*, which are placed vertically between the sheet-metal forms, and the work is then clamped as shown in Fig. 54. The job rests on a 3-in. cast-iron floor plate, and the first ladle of metal poured tends to solidify at the bottom and makes it unnecessary to use fire clay or other luting material. In the case here described three men did the pouring with ladles holding say 10 lb. of metal each. As the babbitt was run into the 1-in. gap between the work and the forms a stick was pressed down into the liquid material at different points and the gases allowed



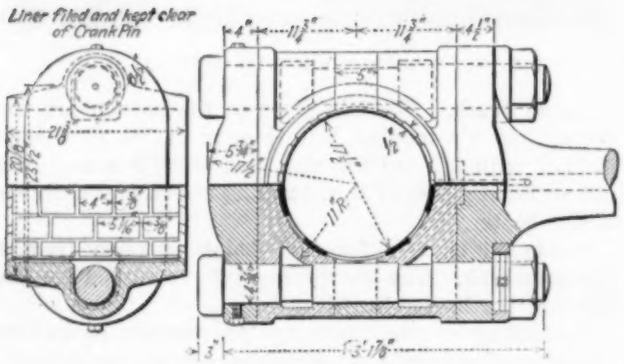


FIG. 50. DETAILS OF ROD END AND BRASSES

to escape as fast as the pouring was done. When the running of the metal was completed and the forms removed a clean, smooth surface was found with the babbitt well solidified at all points in the brass.

The formula for the metal used, which is employed by the Navy for white-metal bearings and for bearing surfaces, is: Copper, 4 per cent.; tin, 89 per cent., and antimony, 7 per cent.

Machining the Bearings

The first operation in the machine shop consists of peening in the babbitt until its entire surface has been well worked and compressed, after which the job is ready for boring and facing in the horizontal boring machine, Fig. 55.

The lower brass is placed on parallels and held by clamps at the four corners. Four spacing blocks are placed on the brass to represent the thickness of the 5-in. liners that are to be used between the brasses when secured to the connecting-rod. The upper brass is placed on the spacing blocks and clamped in place.

The two brasses must be correctly located in reference to each other and also in parallel position to the axis of the boring bar, and the table and boring bar adjusted to secure the central position for the bore through the work. The central position of the bar and work is obtainable with close degree of approximation

FIG. 51. MELTING OUT THE OLD METAL

by measuring and calipering between bar and brass; but this is a preliminary setting that is further adjusted by means of an indicator which is brought into service for the purpose of aiding in the facing-off of the superfluous babbitt metal at the ends of the brasses.

Use of the Indicator

The indicator used is a dial test instrument secured in a clamp holder by means of which it is secured to a tool shank placed in the boring head. The boring bar is then rotated by hand and the corners of the brass indicated to assure the ends of the work being square with the boring bar axis. With the work thus set it is clamped and the facing of the babbitt is then accomplished.

The tool used is a long facing tool with a thin edge ground to a keen rake. The chip taken is very light,

FIG. 52. MELTING THE WHITE METAL OVER AN OIL HEATER

but the tool extends clear across the inch or more of babbitt so that the metal is removed in the form of light shavings. This facing cut is carried down to the surface of the brass and the job is then ready for final setting for the boring of the babbitt and the finishing of the ends.

It will be understood that these old brasses are to be so machined as to go back into the rods from which

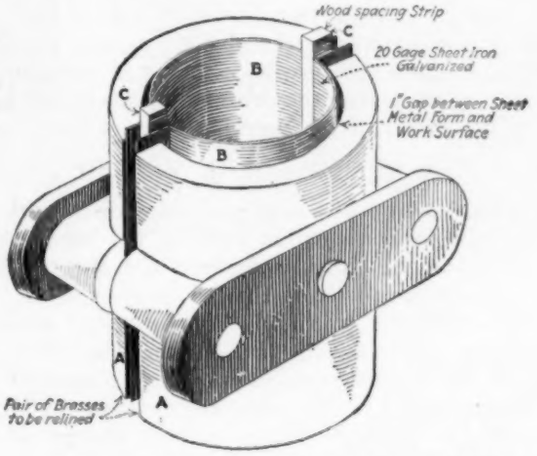


FIG. 53. THE FORM IN PLACE FOR POURING

they were removed and work properly when placed in service. The conditions are different than if they were a new piece of work and were to be fitted to a connecting-rod actually in the shop at the time. The rod is however out at sea and in operation with another set of brasses, and this means that the setting points for the work on the boring machine must be obtained from the old brasses. Hence the application of the indicator to the ends of the brasses.

TABLE III. U. S. S. "VESTAL" OPTICAL REPAIR CARD
Completed Work

Ship	Instrument	Total No.
Alabama	Telescopes	4
Alabama	Rangefinder B. & L.	1
Arkansas	Clock, fireroom	1
Arkansas	Stop watch s	7
Celtic	Stadimeter	1
Celtic	Clock	1
Connec icut	Stop watches	6
Conne:ticut	Clocks, deck	2
Delaware	Stop watches	12
Delaware	Thermometer	1
Delaware	Stop watches	8
Delaware	Telescopes	4
Delaware	Telescopes	1
Delaware	Periscope	1
Despatch	Watch, comparing	1
Florida	Telescope	1
Florida	Rangefinder B. & L.	1
Florida	Stop watches	18
Illinois	Watch, comparing	1
Illinois	Stop watch	1
Illinois	Clock, fireroom	1
Illinois	Stop watches	5
Illinois	Spotting glass	1
Illinois	Telescopes	2
Illinois	Stop watches	1
Kansas	Telescopes 13½	2
Kansas	Telescopes 12½	1
Kansas	Binoculars 4½	1
Kearsarge	Clock, deck	1
Kearsarge	Watch, comparing	1
Louisiana	Rangefinder	1
McCall	Sextant	1
Michigan	Stop watches	6
Michigan	Stop watches	4
Michigan	Periscope	1
Michigan	Telescope	1
Michigan	Rangefinder	1
Michigan	Stop watches	3
Michigan	Stop watches	1
Michigan	Binoculars	1
Michignn	Stop watches	4
Michigan	Periscope	1
Minnesota	Telescope	1
Minnesota	Telescope	1
Missouri	Clock, boat	1

(Name) In charge of optical work. (Rank) 4—2553

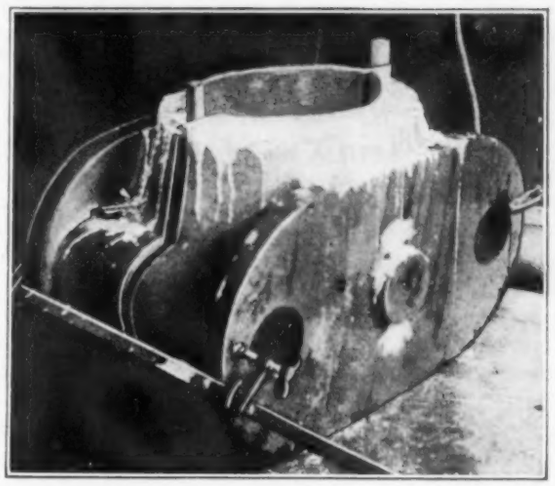


FIG. 54. A PAIR OF BRASSES AFTER RELINING

The boring is done with three cuts. There is about $\frac{3}{8}$ in. of metal all the way around to remove, and the first cut takes about $\frac{3}{16}$ in. on a side. The next cut

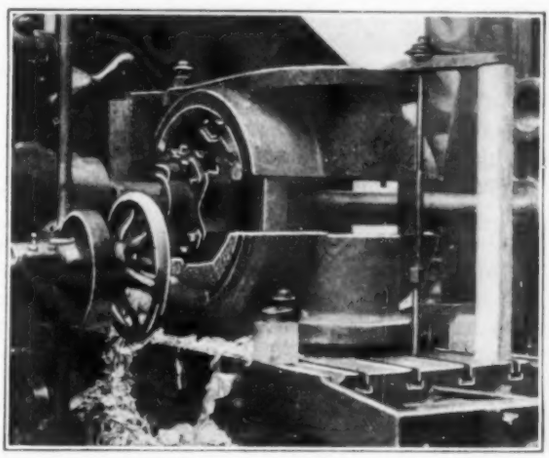


FIG. 55. FACING AND BORING THE LINING

removes $\frac{3}{16}$ in. less $\frac{1}{64}$ in., which is left for the finishing cut. The first two cuts are taken with $\frac{1}{16}$-in. feed and the finish cut with a feed of $\frac{1}{32}$ in. per revolution of tool.

What Is the Matter With the Straw Boss?

BY CLIFFORD H. DENGLER

Late one afternoon when everybody in the drafting room of one of America's largest aircraft plants was busily engaged in working out ideas or laying down plans for tools or machinery destined to win the war the door burst open and an important appearing young man with indignation in his eyes blew in and sought the desk of the chief tool designer.

The young man carried a blueprint, and soon he and the chief had their heads together over it, their conversation being generously interspersed with emphatic gestures expressive of disapproval on the part of the young man while the chief appeared to be temporizing.

After some minutes of discussion the two went over to a draftsman near the center of the room, who was evidently the center around which a storm was brewing. The blueprint was laid on his board, an accusing finger

pointed to the middle of its anatomy and a magisterial voice demanded to be informed "why in thunder," etc., etc.?

The chief makes no comment and the draftsman is plainly worried. He seeks first to justify the construction which the young man has indicated was not in accordance with their usual practice by saying that it will "work just as well that way," or "it costs less to make it" and many other stock excuses of the drafting room until he suddenly remembers, "Why, Mr. Mann ordered it that way."

Mr. Mann is the man "higher up." The displeased young man subsides, rolls up the blueprint, exits R. U. E. or any other old convenient place, while peace again broods over the department.

Presently Neighbor-on-the Right says in a stage whisper to Man-in-the-Center: "S'matter wid de guy?" "Design didn't suit him," replied Man-in-the-Center.

"Whatsee know about it?"

"Nawthin."

"Whosee any way?" inquired Neighbor-on-the-Left who was himself new to the job.

"Oh, he's just a straw boss out in the toolroom," said Man-with-a-Gray-Moustache; "he ain't got anything to say; that's why he talks so much."

"Well, he's got his nerve with him anyway," said Neighbor-on-the-Left, "comin' in here and tellin' us tool designers our business."

"Oh, his kind are allatime tryin' to put over the buck," says Man-at-the-Center. "Serves to cover their own ignorance."

"Don't blame the kid," says the chief, "he's young yet. Maybe he'll learn something when he grows up."

So it is wherever you go. No matter what line of business he may be in, the straw boss or subforeman is the goat and commands about as much respect as our story indicates.

Why is this thus? His position shows that he was picked out from among his fellows probably on account of some superior qualification, and when a vacancy occurs higher up the straw boss is the man on whose shoulders the mantle will fall, and when this happens he generally makes good in his new position. Why does everybody hate a straw boss?

Those Opulent Munition Workers

By L. L. Thwing

In the Metropolitan Museum of Art or some other place is preserved in the form of a tablet of imperishable clay the original mother-in-law joke perpetrated by some prehistoric Joe Miller about the year four-thousand-and-something-or-other B.C.

Though I have not heard definitely of its discovery I am inclined to believe that a similar tablet has recently been unearthed which translated reads something like as follows:

"Mr. Ptolemy Smith, the well-known manufacturer, whose brick yard is located in the rear of Nile St., while pricing some shirts in a leading haberdashery was astonished to learn that the shirts which he had regularly purchased at two pieces of silver had advanced to four pieces of silver.

"Though Mr. Smith is one of our wealthiest citizens he has made it a lifelong rule never to pay more than two pieces (or at most two pieces and a half) of silver for a shirt, and while he was mentally debating as to whether he should break the rule and pay the extortionate price or appear in public in his pajamas a rough-looking individual with soiled hands and clothing streaked with bronze dust snatched the garment from the hands of the sales person, inspected it, paid for it in cash and ordered it sent to the Spear Makers' Club.

"Inquiring of the sales person Mr. Smith soon discovered that the shop's best customers, who were demanding the best of everything, were the munition workers, whose wages had been increased to incredible amounts by reason of the enormous demand for labor due to the war with the Persians."

Now Being Worked to the Limit

As stated above, this tablet has been discovered and is now being worked to the limit by the hard-pressed reporters for the daily papers and the story writers on the weeklies, as witness the following:

"Mother Brown, who has run a boarding house in Bridgeport, Conn., for the past 17 years, has discovered that the 'boys' want more class to their provender and are willing to pay for it, so she has engaged the former chef of the Biltmore Hotel to take charge of the cuisine."

"It is stated that a die cutter in a local shipyard received $228 a day for four weeks;" that "the poorest-paid laborers in the yard receive more than an ensign;" that "the visible supply of stencil pianos, limousines and tan shoes is fast getting into the hands or onto the feet of the munition workers" and that "hundreds of limousines waited each night to take these toilers home." These statements were later denied in small print.

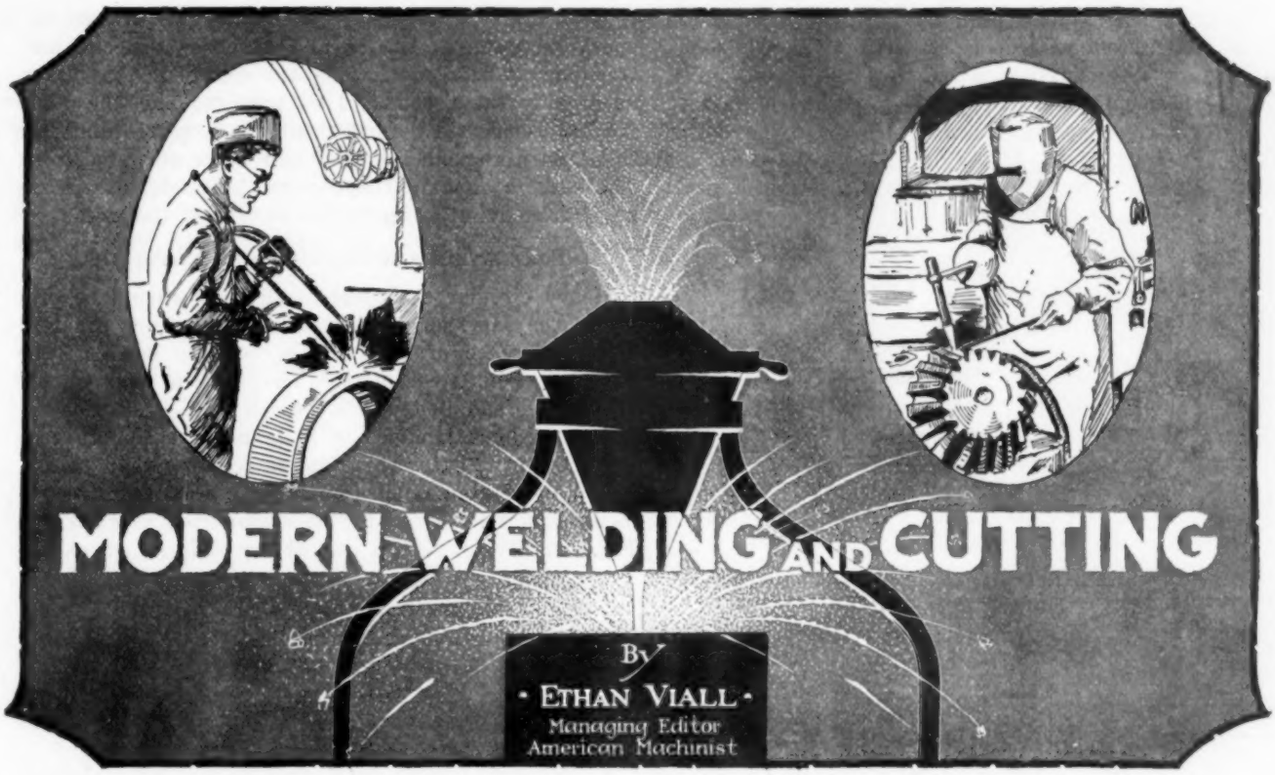
If all our industrial experts with the pen were to confine their writings to what they see themselves there would be less occasion for all of us to Hooverize on white paper.

Not in Accord with Individual Experience

My own experience in a shop employing 1000 men discloses little evidence of undue prosperity on the part of the employees who have been in the shop since before the war. One or two callow youths of tender years and slight responsibilities have broken out with second-hand Fords, and the moving-picture houses have business enough to warrant keeping open every night instead of two nights a week as formerly, but I defy expert investigators to prove that we are living like the prodigal son.

Mechanics in general being made of the same material as the rest of mankind, you may naturally expect to find some who are not looking ahead to the time when husks may be the only item of their menu, but the manner of living of the majority is not so different from before the war.

There are some, of course, who by reason of the abnormal conditions and scarcity of labor are getting more than they ordinarily would, but if any piece-worker can back up a pneumatic riveter hard enough, fast enough and long enough to earn three or four times the normal wage he is three or four times as valuable to the country, and if he happens to want a silk shirt far be it from me to say that he shall not have it.



IV. Thermit Welding—Welding New Necks on Large Steel Pinions*

The examples of steel-pinion work shown in this article are typical of welds that may be made on many other large machine sections. The illustrations presented give some examples of marine repairs and are of suggestive value to users of many classes of large machine tools.

FREQUENT breakages of heavy pinions in steel plants have resulted in the development of a very ingenious adaptation of the Thermit process for their repair. Obviously the casting on of a new neck entirely out of Thermit steel would be a very expensive operation and it would also be costly and difficult to turn up a new piece of steel and weld it on to the original section, as the weld would be a very large one to make. Experience has shown, however, that the intense heat of the reaction can be utilized for the purpose of bringing the broken surface of the pinion to a fusing temperature, at which time a supply of liquid steel can be poured in from the ladle, and this will unite with the original body of the pinion to form a new neck thoroughly amalgamated with the rest of the piece.

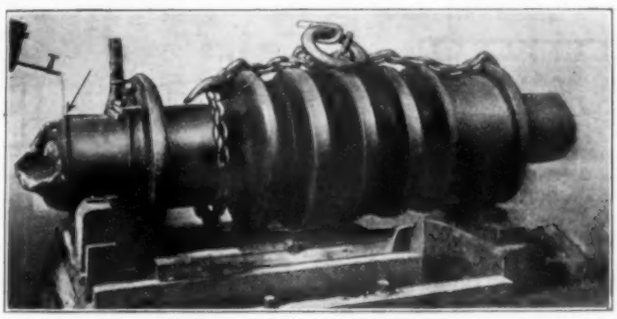


FIG. 37. SAWING OFF END OF NECK PREVIOUS TO WELDING ON A NEW ONE

Briefly the operation consists in constructing a mold around the broken section so as to permit of casting on a new neck to replace the one broken off. The original section is then preheated to red heat by means of gasoline or oil burners, after which Thermit steel from a crucible is allowed to flow over the fractured surface to a depth of 1 in. This completes the heating operation and brings the surface of the roll to the melting point. A supply of liquid steel from a ladle is then tapped into the mold and allowed to wash through and overflow into an ingot mold so as not to be wasted. The overflow gate may then be closed and the mold filled to the top with steel. Detailed instructions for these various operations follow, but it is recommended that if the process is to be used for the first time for such repairs an experienced engineer should be obtained to supervise the first welds and give personal instructions for executing this class of work. The instructions given here have been written more especially for the purpose of acting as a guide for a reference, and while we hope that these are sufficiently adequate and complete to enable anybody to make these welds, the personal supervision and instructions of an experienced engineer are much to be preferred.

We give two methods for executing these repairs. The first method which follows is undoubtedly the safest and surest method to use, but it involves considerably more trouble and expense than the second method. We can recommend it strongly, however, and believe it would be to the interests of steel plants having much of this work to do to equip themselves properly to follow out this method.

*For the author's forthcoming book, "Modern Welding and Cutting." All rights reserved.

Before undertaking a pinion repair the broken end should be cut off square, as shown in Fig. 37, so as to form a level surface when the roll stands in a vertical position. The object of this is to permit of a uniform covering of Thermit steel over the entire surface to be welded. If the break is in the pods, cut off 2 in. below the point where the pod joins the neck.

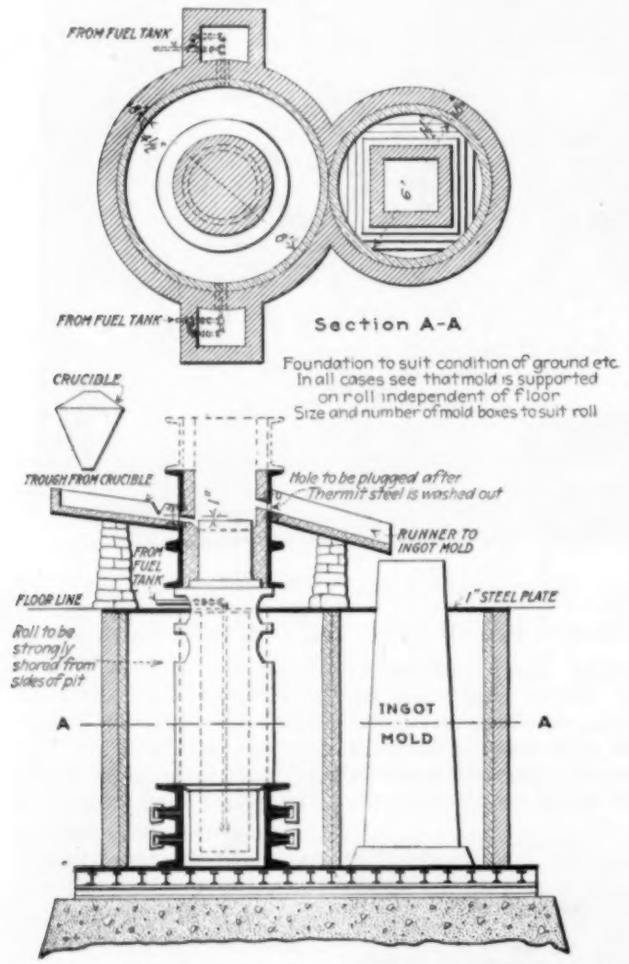

FROM FUEL TANK
FROM FUEL TANK
Section A-A
Foundation to suit condition of ground etc. In all cases see that mold is supported on roll independent of floor. Size and number of mold boxes to suit roll
CRUCIBLE
TROUGH FROM CRUCIBLE
Hole to be plugged after Thermit steel is washed out
RUNNER TO INGOT MOLD
FROM FUEL TANK
FLOOR LINE
1" STEEL PLATE
Roll to be strongly shored from sides of pit
INGOT MOLD
A
A

FIG. 38. A DESIGN FOR A PERMANENT PIT FOR WELDING NECKS ON LARGE ROLLS AND PINIONS. IF DESIRED A REMOVABLE FIRE-BRICK PARTITION MAY BE USED BETWEEN ROLL OR PINION PIT AND THE INGOT MOLD PIT

If when the neck is cut off it should be found to contain any pipes or cavities these should be bored out and steel plugs turned to a driving fit and driven into the cavities at least 5 in., care being taken that the plugs are driven in even with the surface on the end of the neck.

Another and better method is to dry out the inside of the cavity by heating and then fill with liquid steel. This will eliminate any danger of the Thermit metal melting the plug and running into the cavity, which might cause a violent and dangerous eruption of the steel. Clean off all dirt and grease at least 20 in. from point of weld.

A riser pattern should be provided, undercut as shown in Fig. 32-E, also a pouring gate and overflow gate pattern.

The riser pattern should be 3 in. larger in diameter than the pinion neck, and at the lower part, where it joins the neck, it should taper as shown. Where the operation requires the casting of pods a special pattern should be made having the shape of the pinion neck with these pods. This pattern, like the riser pattern mentioned before, should be larger in diameter than the pinion neck and should taper at the bottom. The pattern should, if necessary, be made in sections so as to allow of being withdrawn from the mold.

Foundation and Heating Arrangements

Heavy circular cast-steel mold flasks should be provided, the same as are used in steel-foundry practice. In the absence of these flasks suitable ones can be made of ½-in. steel plate. The bottom flask should be divided and bolted together so that it can be removed without trouble, as it is much easier to tear down the mold after this flask is removed than before.

In undertaking repairs on these pinions it is recommended that a special pit be constructed as shown in Fig. 38. It is of the utmost importance when constructing the pit to provide a good foundation for the bottom of the pit. It has been found in many cases that steel plants are built on low and marshy ground, therefore when a pit is dug the ground is apt to be soft and many times water seeps in. For this reason the design in Fig. 39 is shown. However, unless precautions are taken to provide a good foundation heavy pinions are apt to settle before the welding

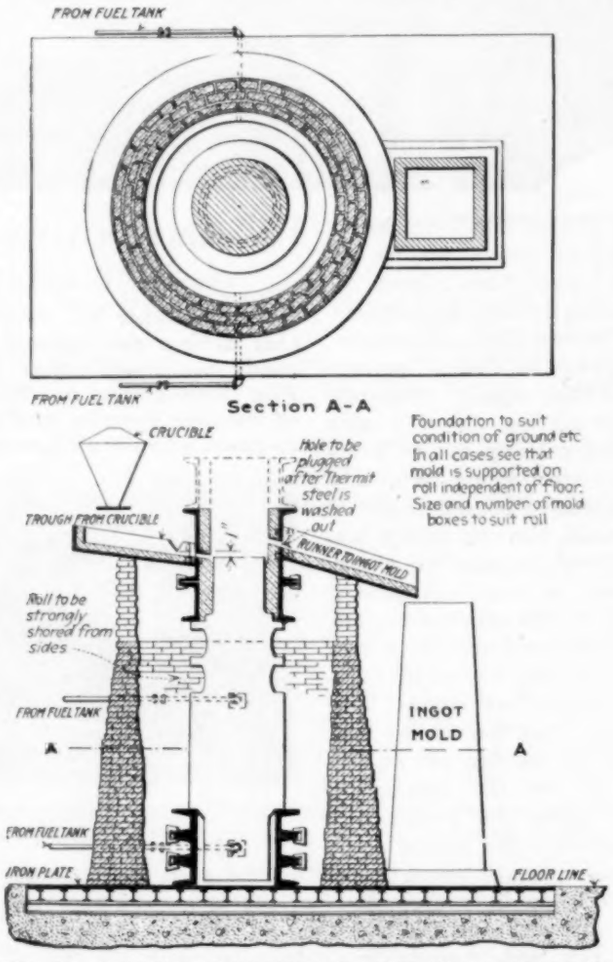

FROM FUEL TANK
FROM FUEL TANK
Section A-A
CRUCIBLE
Hole to be plugged after Thermit steel is washed out
Foundation to suit condition of ground etc. In all cases see that mold is supported on roll independent of floor. Size and number of mold boxes to suit roll
TROUGH FROM CRUCIBLE
RUNNER TO INGOT MOLD
Roll to be strongly shored from sides
FROM FUEL TANK
INGOT MOLD
A
A
FROM FUEL TANK
IRON PLATE
FLOOR LINE

FIG. 39. METHOD OF WELDING ROLL NECKS WITHOUT DIGGING A PIT

operation is completed. This is liable to cause a loss of the repair and sometimes a serious explosion might result caused by the hot metal coming in contact with moisture. When an adequate foundation has been provided set the pinion and the ingot mold in place and brace them strongly to the sides of the pit.

Arrange the heating burners which may use gas, gasoline or kerosene. This arrangement is shown, although the complete connection to the fuel supply is not.

Constructing the Mold

Construct the mold, as shown, of sharp silica sand and fire clay. The usual proportions of the mixture are three parts of sand to one of clay, but this varies according to the sand and clay used. Coat the mold with a good

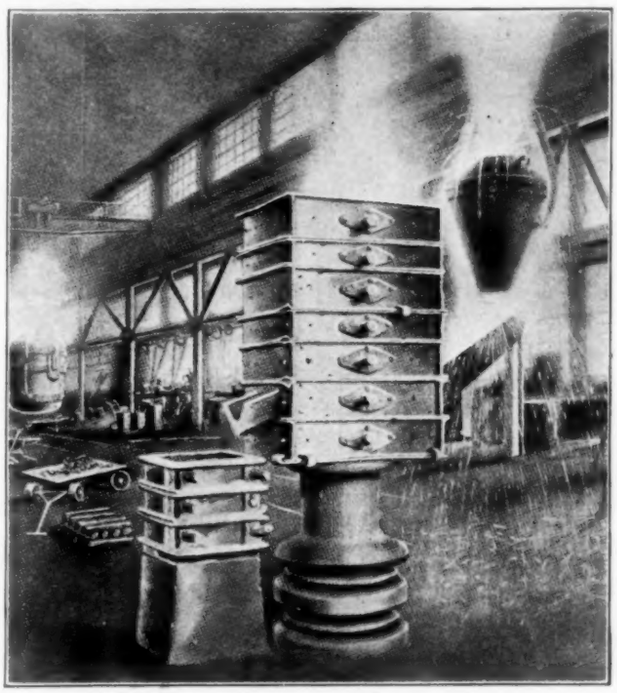


FIG. 40. WELDING A ROLL NECK. THERMIT STEEL TAPPED INTO MOLD AND LADLE OF STEEL AT LEFT READY FOR FINAL OPERATION

steel wash and drive in nails or chaplets to hold the sand in position.

Attach the runners at the proper points and ram them with the same material, being careful to arrange the runner for the Thermit exactly as shown, that is, the runner gate is so placed that when the Thermit steel has run into the mold the top surface of the neck will be covered with superheated Thermit steel to a depth of about 1 in., and the slag from the Thermit reaction will flow from the crucible and run out of the V-shaped notch in the side of the runner, thereby preventing any slag from entering the mold.

The overflow runner should have sufficient pitch so that the liquid steel will flow to the ingot mold readily without spattering. Firebricks should be laid on top of the ingot mold in order to prevent steel from spattering at that point.

When the mold is completed start the preheating of the body of the pinion. If gasoline or kerosene is used three double or five single preheaters will be required and another one should be kept filled and ready to be cut in when any one of the others has become empty. This will prevent loss of heat while a preheater tank is being refilled.

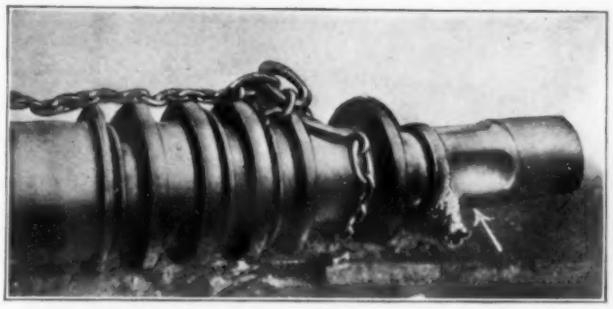


FIG. 41. ROLL NECK WELDED TO LARGE STEEL ROLL WITH PODS CAST IN

As the body of the pinion approaches a red heat start the preheating of the top of the neck as shown in Fig. 32-B. Heat this surface to a good réd heat, timing the operation so as to have both neck and body of pinion red hot at the time the openhearth steel is tapped out of the furnace.

While the preheating of the neck is progressing set the automatic crucible, size 7, charging it in accordance with previous directions, so that it will be ready when needed.

Amount of Thermit Required

In calculating the amount of Thermit required for this type of repair allow 75 lb. of railroad Thermit for each square foot of surface it is desired to melt down.

Be sure that the cope has been baked while the preheating of the neck is going on (either in an oven or as shown in Fig. 32-H) and is located conveniently so that it can be brought up with the crane at the proper time. After the furnace is tapped raise the ladle of steel and try the stopper by making a couple of pours to be sure that the stopper works properly and will shut off tight.

Move the ladle to a point near the mold so that no time may be lost between pouring the Thermit steel and washing through the steel from the ladle. *Remove the preheaters to a safe distance.*

Ignite the charge of Thermit in the crucible, and

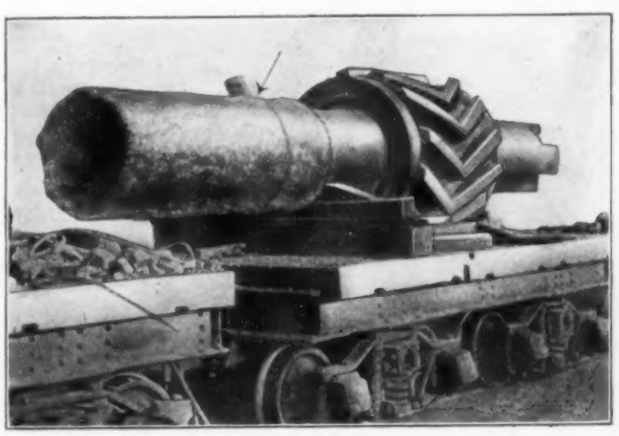


FIG. 42. NEW NECK WELDED TO LARGE STEEL PINION. IN THIS CASE THE PODS WERE MILLED AFTERWARD

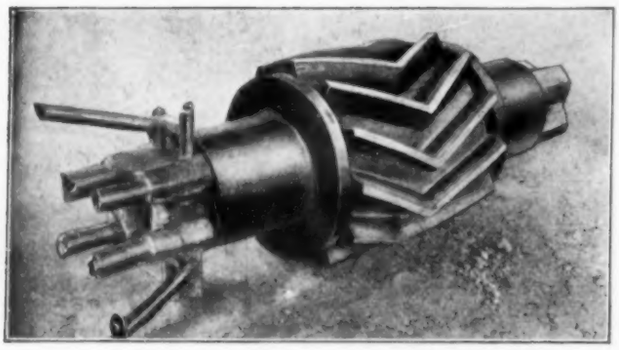


FIG. 43. WORN PODS BUILT UP WITH THERMIT STEEL. THE REPAIR CONSISTED OF FOUR WELDS MADE SIMULTANEOUSLY, USING TWO POURING GATES AND TWO CRUCIBLES

when the reaction is over (usually 35 to 50 sec.) tap the Thermit steel into the mold, as shown in Fig. 40. When all the steel from the crucible has flowed into the mold the slag will commence to run over the V-shaped notch in the pouring runner. Move the crucible out of the way and plug the pouring gate with a sand core provided for this purpose, banking up securely behind it to prevent leakage.

Lower the ladle of openhearth steel, shown at the left, to a point close to the top of the mold and tap the steel into the mold, running through about 5000 lb. into the ingot mold which has been set for the purpose, as shown.

Plug the runner gate with a core constructed as shown in Fig. 32-J and bank up well behind it so that there will be no danger of a runout. *Be careful in plugging this gate on account of its size.* After the plugging is completed and banked up, the sand should be weighted down as an extra precaution to prevent accident.

After the overflow has been securely plugged fill up the mold with steel from the ladle and cover it well with dry sand or charcoal to keep the metal hot.

Treatment When Cope Is Used

If a cope is used clean off the surface of the top of the mold and set on the cope, clamping it securely, and then fill the cope to the height desired with steel and again cover over with dry sand or powdered charcoal.

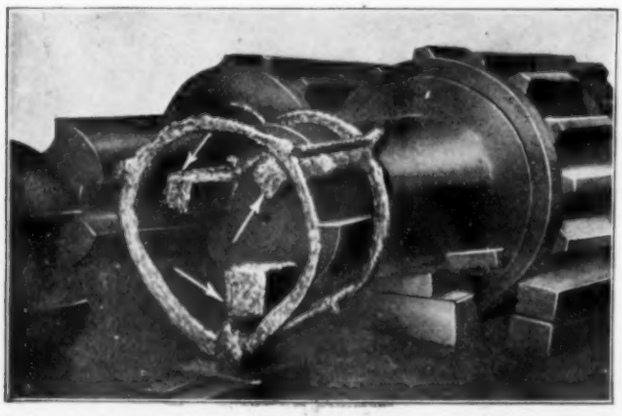


FIG. 44. BUILDING UP WORN PODS BY MEANS OF THREE THERMIT WELDS. POURING GATES WERE CONNECTED AT TOP AND BOTTOM TO INSURE EQUAL DISTRIBUTION OF METAL

If the body of the roll or pinion has cooled to any extent it would be desirable to again preheat it. After the body of the pinion is sufficiently preheated cover the pit to make it as nearly airtight as possible, so

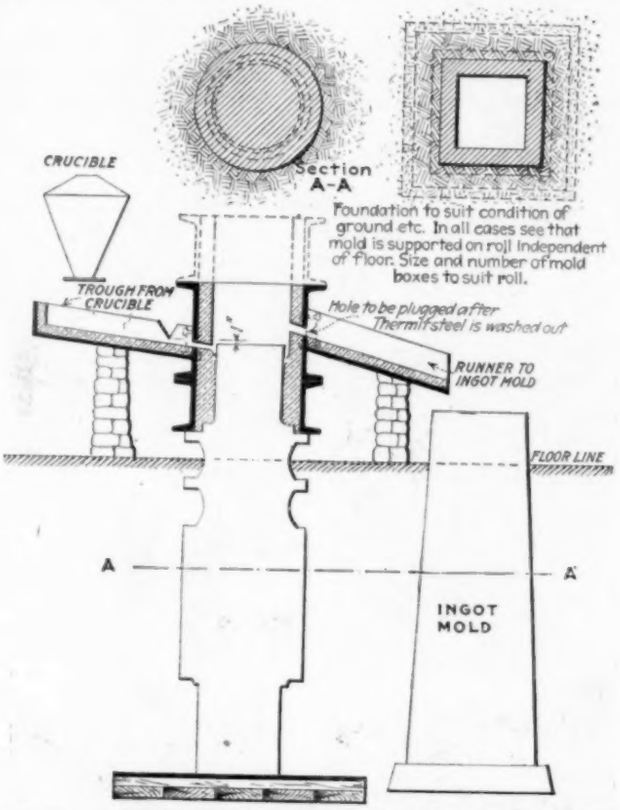

CRUCIBLE
Section A-A
Foundation to suit condition of ground etc. In all cases see that mold is supported on roll independent of floor. Size and number of mold boxes to suit roll.
TROUGH FROM CRUCIBLE
Hole to be plugged after Thermit steel is washed out
RUNNER TO INGOT MOLD
FLOOR LINE
A
A
INGOT MOLD

FIG. 45. ALTERNATE METHOD OF SUPPORTING ROLL OR PINION TO BE REPAIRED

as to cause the roll or pinion to cool slowly. By doing this further annealing is unnecessary.

After the pinion is sufficiently cool (usually about 48 hours or more) remove from the mold and machine to size.

In some steel plants it is considered preferable not to use a cope but to build the mold all in one piece

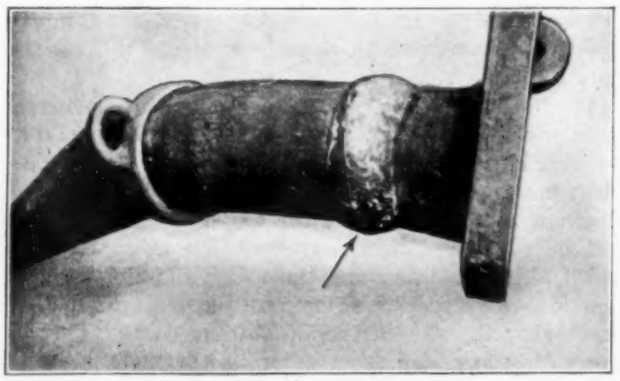


FIG. 46. FINISHED WELD ON ANCHOR DAVIT OF U. S. S. "OLYMPIA"

to the height of the new neck. This method simplifies the making of the mold and the pouring of the weld, but sometimes complicates the operation for the following reasons:

When riser patterns are withdrawn it is a little more difficult to remove loose sand from the mold.

In preheating it is not so easy for the operator to see what he is doing.

There are times when these necks will be as much as 5 ft. high, which makes it a little unhandy to work around the mold.

There are numerous arguments on both sides of the question, but we feel that either method will give good results. For short necks, however, a cope can probably be dispensed with without introducing any difficulty.

Two welding jobs just as they came from the molds are shown in Figs. 41 and 42. The first is a neck welded onto a large steel roll with the pods cast in.

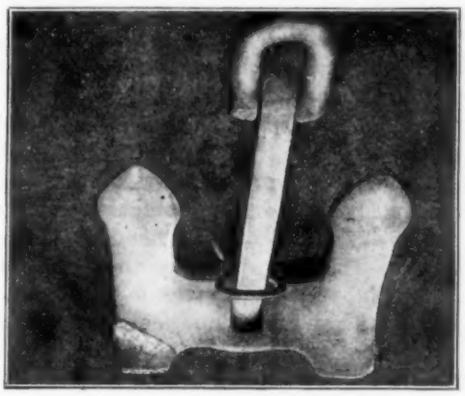


FIG. 47. ANCHOR OF THE MORGAN YACHT "CORSAIR" REPAIRED WITH THERMIT

The second one shows a new neck welded to a large steel pinion. In this last case the pods were milled cut afterward.

Two other welding jobs are shown in Figs. 43 and 44. These both illustrate the repair or replacing of worn pods on heavy steel mill pinions.

Alternate Method

While the preceding directions cover the welding of pinions under what might be considered ideal conditions it is not always possible to do the work in this way, and where such is the case we would recommend that the following directions be followed, as they represent a simpler method, yet one which has always resulted in satisfactory repairs:

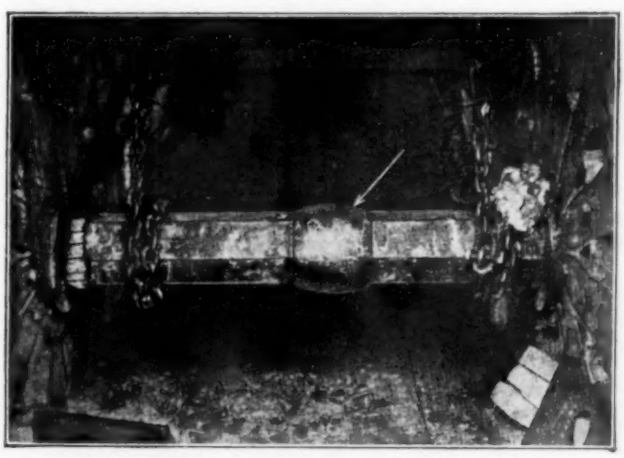


FIG. 48. WELD ON WHEEL SHAFT OF STEAMER "NASHVILLE" ON THE CUMBERLAND RIVER, MADE IN 1912

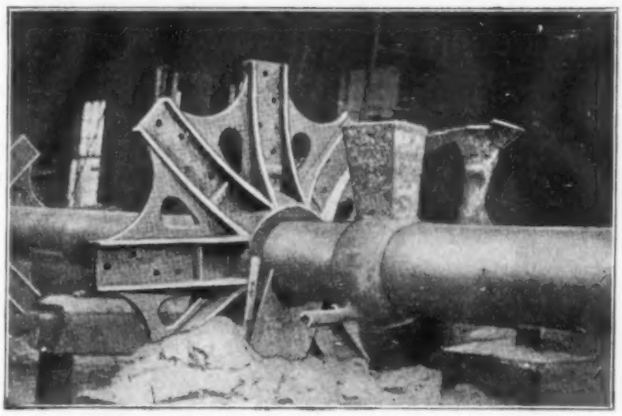


FIG. 49. WELD ON 10-IN. WHEEL SHAFT OF STEAMER "OSCEOLA," MADE AT JACKSONVILLE, FLA., IN 1915

Patterns, mold box, runners, etc., should be constructed in accordance with directions given for the previous method.

In these repairs great care should be exercised in supporting the pinion so that there is no danger of its settling under the added weight of the mold and the steel which is poured into it. If it is not desired to go to the expense of constructing a special pit as outlined in the previous method a satisfactory and economical way is to dig a hole in the ground about 8 ft. in diameter and of sufficient depth to receive at least $\frac{3}{4}$ of the entire length of the pinion. Cover the bottom of the hole by laying a double flooring of 2-in. planking, being careful that the planks in one

FIG. 50. WELD ON STERNPOST OF TUG NO. 32, MADE SEPTEMBER, 1911

layer run in opposite directions to those of the other layer.

On top of this place a steel plate in order to distribute the weight of the pinion over the entire floor area. Such a foundation has always proved adequate and is not expensive.

Set the pinion in the hole so that the surface to be welded is level and fill in all around the pinion with dirt, ramming hard to hold the pinion permanently in position.

Dig a second hole alongside of the buried pinion to

receive the ingot mold. This should be at such a distance from the pinion that a suitable runner for the overflow steel can easily be placed. The top of the ingot mold should, of course, be lower than the top of the roll or pinion neck.

If the neck is broken off close to the body of the pinion it is absolutely necessary to provide arrange-

FIG. 51. STERNPOST WELD ON THE "WILLIAM HENRY MACK," JULY, 1912

ments for preheating the body protruding above the ground in order to avoid shrinkage strains. A simple way to do this is to build up a brick furnace and heat in accordance with directions relating to casting of teeth in large pinions, and more of the pinion body should protrude above the ground than shown in Fig. 45. If, however, there is one foot or more of neck protruding from the body of the pinion, it is not absolutely necessary to preheat the rest of the pinion.

The mold box should be constructed with heavy steel flasks or a substitute made of at least ¼-in. plate

FIG. 52. ANOTHER STERNPOST WELD. S. S. "CORUNNA" OF THE CANADIAN LAKE TRANSPORTATION CO., MADE IN 1907

and should be supported entirely on the roll and independent of the ground.

With the mold box adjusted in place ram up with good molding material in accordance with the previous directions and then draw out the various wooden patterns. Nails or chaplets should be driven into the sand so as to hold it firmly in place. It is advisable to coat the mold with a good steel wash. When the mold is completed the preheating of the body of the pinion should be started if the repair is of such a nature as to require this preheating. If this heating is not necessary start preheating on top of the neck as shown in Fig. 32-B. If the body of the pinion is heated the heating of the neck should not be started until the pinion approaches a red heat.

Heat the surface on top of the neck to a good red heat, timing the operation so that it will be red hot at the time the openhearth steel is tapped out.

While the preheating of the neck is progressing set an automatic crucible, size 7, as shown in Fig. 45, and charge it so that it will be ready when needed. If possible it is best to support the crucible with a crane so that it can be quickly removed after it has been tapped. The procedure is then the same as described for the previously given method. After cooling, strip the mold and machine the parts to proper size.

It is sometimes desirable where the body of the pinion has been preheated to continue this heating after the weld is completed. This can easily be done by again igniting the burners directed into the brick furnace. After the body is sufficiently preheated remove the burners and fill in between the bricks and the pinion with dry sand so as to cause slow cooling. By doing this further annealing is unnecessary. As previously mentioned, a cope may or may not be desirable, and this is left to the judgment of the operator.

Marine Work

The general principles to be followed in making marine repairs are the same as for any other repairs of a similar size and nature, so no detailed description need be given. However, it will be of interest to know the exact nature of some of the more common repairs made on anchors, wheel shafts, sternposts or the like, so a few views of some of the actual repairs are shown. A big point in favor of the Thermit process in cases like the ones given is the short time necessary for the ship to be laid up. In many cases little or no dismantling is necessary. In a number of stern shoe welds on lake steamers the sizes of the parts at the break have been from 11 x 16 in. to 10 x 20 in. or more, and the average time required has been about 36 hours complete. On a large number of ocean-going vessels the welds made have been on sections of larger dimensions than those quoted.

In Fig. 46 is shown a weld on the anchor davit of the famous U. S. S. "Olympia." Fig. 47 shows a repair on the anchor of the Morgan yacht "Corsair." Fig. 48 is a repair on the wheel shaft of the "Nashville," a Cumberland River steamboat, made in 1912. Fig. 49 shows a repair on the wheel shaft of the river steamer "Osceola," welded at Jacksonville, Fla., in 1915. Fig. 50 shows a sternpost weld on a tug, made in 1911. Another sternpost weld is shown in Fig. 51.

Compressed Air in a Shell Plant

By R. E. C. MARTIN and S. B. KING
In *Mine and Quarry*

The convenience, adaptability and economy of air power for industrial and manufacturing purposes are well illustrated by its use in the manufacture of shells. In this field it is speeding up some operations, reducing the labor required for other jobs and performing still other processes difficult to accomplish by other ways.

THE uses of compressed air are well demonstrated at the plant of Winslow Brothers Co. at Chicago, which before the war manufactured ornamental iron and bronze for architectural purposes. This business falling off, by reason of inactivity in the building-construction line, the plant was converted to the manufacture of munitions and a new equipment especially adapted to the manufacture of 155-mm. shells was installed.

The shell blanks are delivered to the factory in the form of pressed or drawn steel forgings, cylindrical in shape, with one end closed, weighing about 180 lb. each. In many of the 47 operations performed at this plant compressed air forms a time and labor saving agent of the first importance. Air chucks of improved standard pattern are used on practically all the lathes and boring tools for holding the work and releasing it quickly. These processes include cutting off the end of the shell blank, rough and finish turning, turning the nose and base to exact dimensions, turning the bourrelet, turning the waved groove near the base on which the copper ring which engages the rifling is forced, turning the rifling grooves on the ring itself and boring out the interior of the shells. The use of air chucks, by means of which the work can be tightened or released instantly, has been one of the most important contributions to the cutting down of the time required in the turning process and also saves considerable labor. A lathe equipped with an air chuck is shown in Fig. 1.

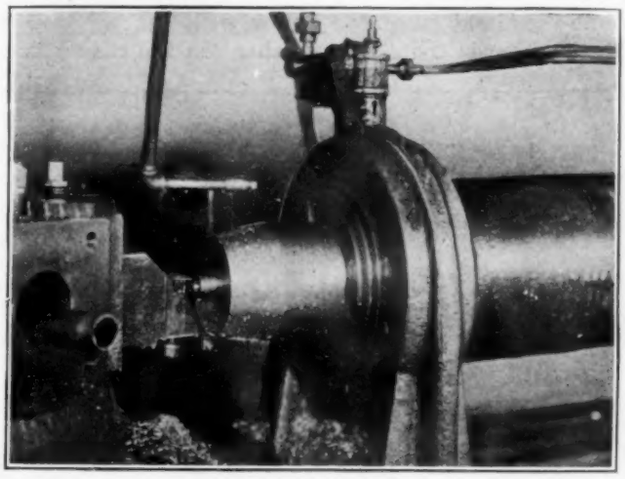


FIG. 1. A 155-MM. SHELL BLANK IN A LATHE EQUIPPED WITH AIR CHUCK

After the shells have been turned to exact dimensions, both inside and out, they are taken to the sandblasting machines, where the roughness left by the tool is carefully removed. Fig. 2 shows a battery of revolving sandblasting machines, with the shells in position. Two cuts or stages of sandblasting are performed. A preliminary blast is first given them and they are then finished on the machines shown, which put the final finish on the interior of the shell. Compressed air is also used in the machine employed for washing out the interior of the shells. The shell is placed nose down over a nozzle, through which steam, caustic-soda solution or air can be discharged as desired to wash, dry and cool the interior. This process removes excess varnish, dirt, etc.

In Fig. 3 may be seen the varnishing machines at work. It would be a difficult and tedious job to varnish the interior of these shells with the degree of care and evenness required by hand. The machine shown is the De Vilbiss type. It consists of a sprayer mounted on a hollow spindle which is connected by hose lines

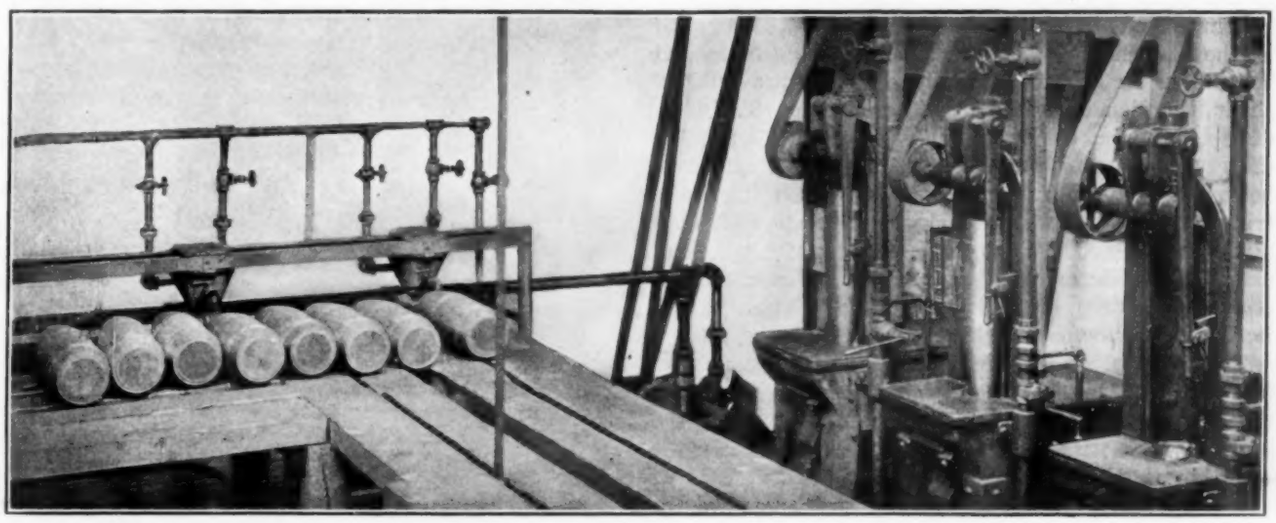


FIG. 2. SANDBLASTING MACHINES. THE SODA-WASHING DEVICE, WITH THREE-WAY COCKS FOR COMPRESSED AIR, STEAM OR CAUSTIC-SODA SOLUTION, IS SHOWN AT THE LEFT

with the air supply and with an overhead reservoir for varnish. It does the work rapidly and well. The spindle is moved forward into the shell and the varnish sprayed onto the interior surface as the spindle is withdrawn. The shell is revolved in the meantime, so that an even coating of varnish is applied.

This is one of the last processes through which the shell goes before it reaches the final inspection by the Government officials at the plant.

Compressed air is also used in the form of a jet to cool the primary windings of the shell-band-heating transformers, or ring heaters, which are employed for heating the copper bands, or rings, which are forced by powerful hydraulic presses into the machined groove near the base of the shell. On these bands the ridges for engaging the rifling are subsequently machined. The jet of compressed air is applied through the base of the winding chamber.

Compressed air for these several processes is supplied at the present time by four Sullivan angle compound belt-driven air compressors, with low-pressure cylinder 14 in. in diameter, high-pressure cylinder 8¾ in. in diameter, and a common stroke of 10 in. An interesting feature of the air installation is that instead of being grouped centrally in a power house it is distributed about the plant at convenient points where the air is most used. This saves long runs of piping and makes for efficiency, as it obviates to the greatest possible extent drop in pressure, due to friction in the transmission line, caused by elbows and turns.

The compressors are equipped with the Sullivan three-pass, counter-current intercoolers in which there are three independent sets of tubes through which the cooling water passes, and the air is forced across the tubes in the separate chambers successively, so that the temperature of the air when it finally enters the high-pressure cylinder is very little above that at which it entered the low-pressure or intake cylinder.

Receivers of ample capacity are installed close to the compressors. A 700-ft. aftercooler is also provided for the compressor that furnishes air to the sandblasting machines and varnishing sprays. It is effective in providing dry air, which is essential in sandblasting the interior of the shells.

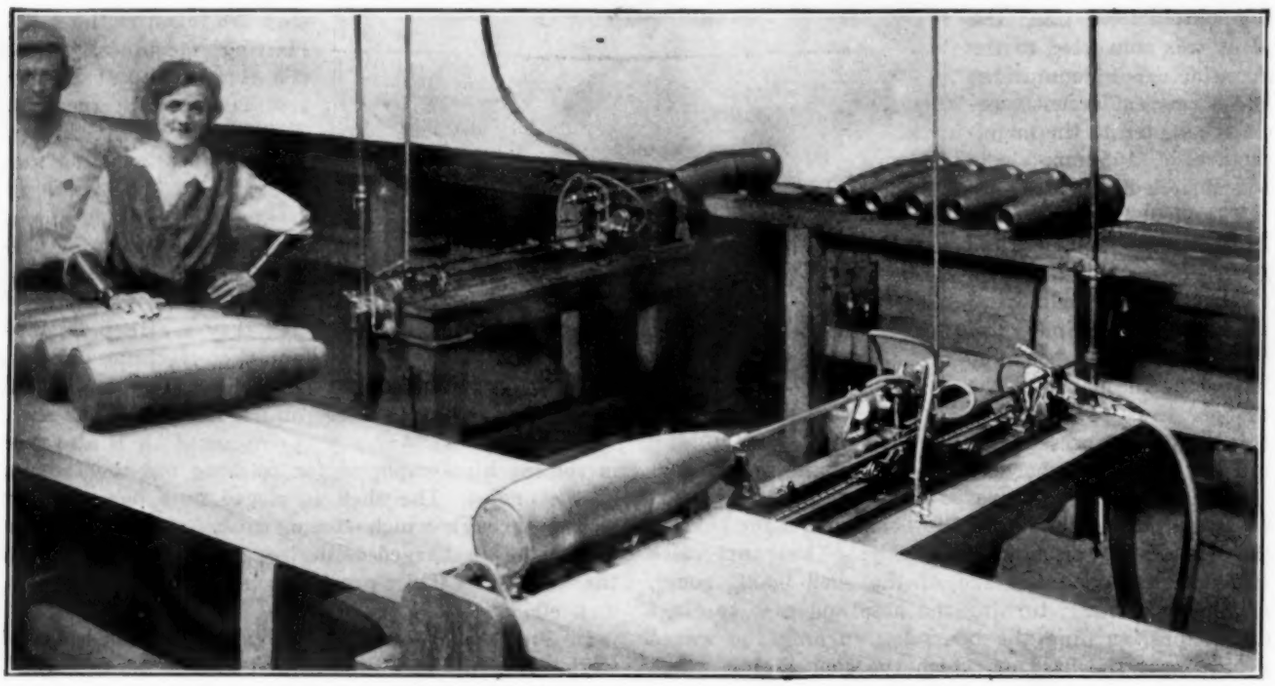
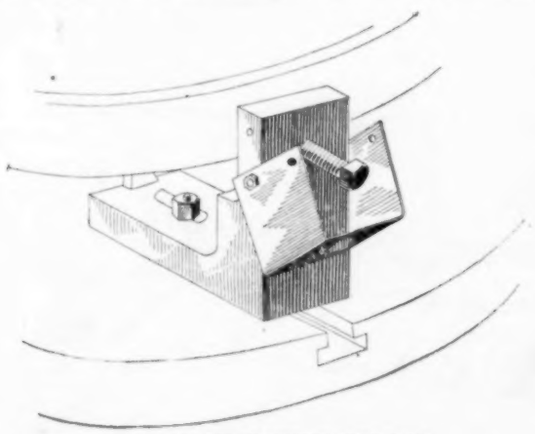


FIG. 3. SHELLS BEING VARNISHED BY COMPRESSED AIR

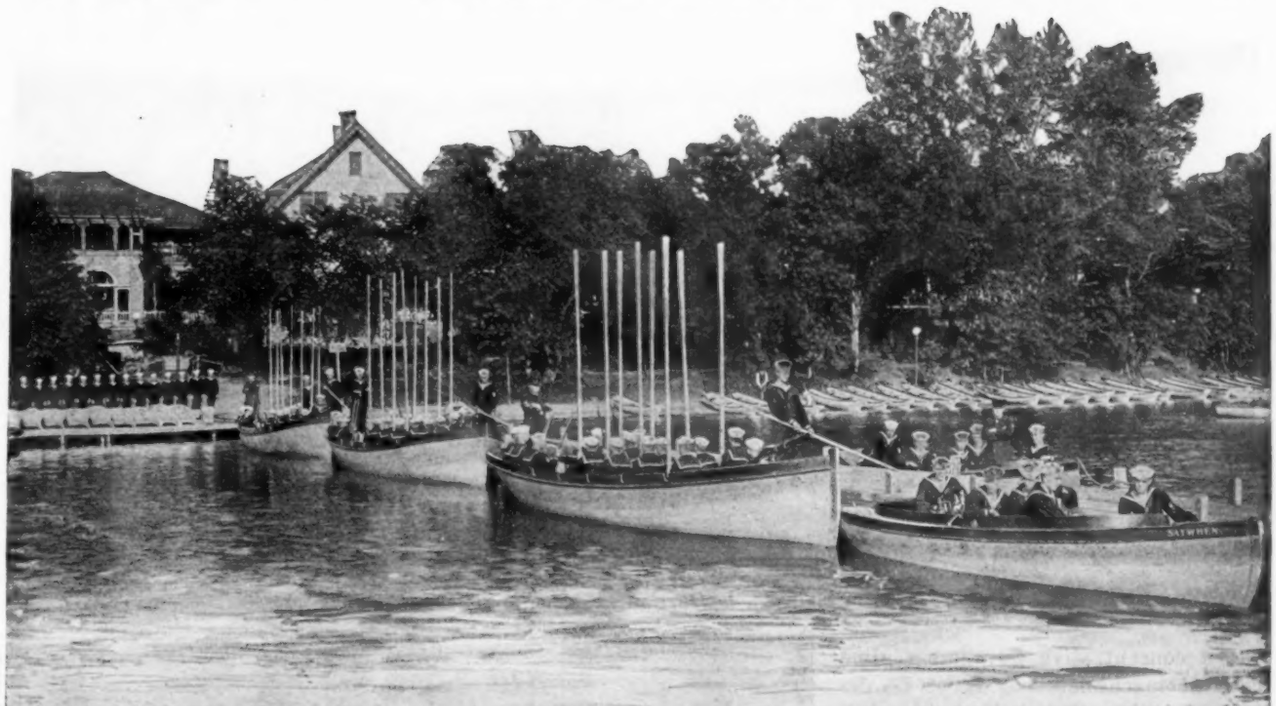
Operator Removes Safety Device

BY JAMES FORREST

The cut shows a safety device which has been running on a vertical boring mill in a prominent shop. This is an example of a safety device which did not meet with the approval of the operator, who would rather run the chance every minute of the day of being caught and mangled than spend the extra two seconds required to put his chuck wrench through the hole in the guard. He also furnished the energy necessary to remove the guard and keep it removed despite the wishes of those looking after his welfare. What can a safety engineer do in the face of such cussedness?



AN UNSAFE SAFETY DEVICE



HOW the NAVY TRAINS its MACHINISTS ASHORE

BY WILLARD CONNELY, U.S.N.R.F.

In the Navy as well as in the Army a great number of machinists and machinists' mates were needed during the war, many more than could possibly be trained in the orthodox manner, therefore the training period was shortened and the method of training simplified and intensified, so that the student received a more comprehensive course in much less time. The training comprised courses in machine work, patternmaking, molding, blacksmithing, sheet-metal working, oxyacetylene welding, boat building and gasoline-engine construction and repair, with academic instruction in mathematics, drafting and electricity.

A BLUEJACKET operating a radial drilling machine in the big machine shop at Dunwoody Naval Training Schools, Minneapolis, was asked what he had been doing before he enlisted.

"I drove a truck for an oil company," he replied.

"Didn't you make more money at that job?"

"Yes, I should say a few dimes more," he answered, "but what good is a lot of extra money to a fellow if he can't save it? One of the greatest things about the Navy is that it makes you save—you don't have any ambition to spend. Besides, in war time, driving a truck around the home town is an old man's job, a job for a man too old to mix in the fight."

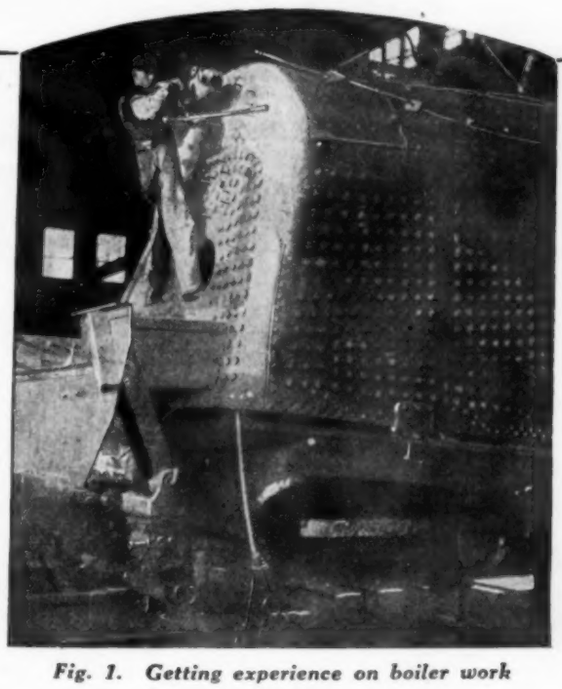


Fig. 1. Getting experience on boiler work

So he had decided to become a general machinist's mate in the Navy, and he had chosen well, for the eight months' course given at the training stations was indeed a liberal mechanical education.

Eight months seemed a long time for young men to be held in leash at a training school when they were so eager to hurry into action with the fleets. However, in peace time the sailors in the machinists' school at Charleston Navy Yard are given 16 months' training, and under the se-

Fig. 2. Classroom instruction in drawing and mathematics

verest concentrative war-time régime efficient machinists could not be developed in less than half that period.

All students who entered the course were assured that their deferred arrival aboard ship would be well compensated for by the extraordinary scope of their instruction. Not a man but should make good, for he was reasonably sure to encounter some angle of the training in which he had a natural, though unsuspected, talent.

Not all of the schooling was given at Dunwoody Institute. The work extended as well to the engineering college of the University of Minnesota, where the apprentices learned the operation of such apparatus as boilers, condensers, marine pumps and ice machines. Va-

Fig. 4. Where instruction is given in blacksmithing and flame welding

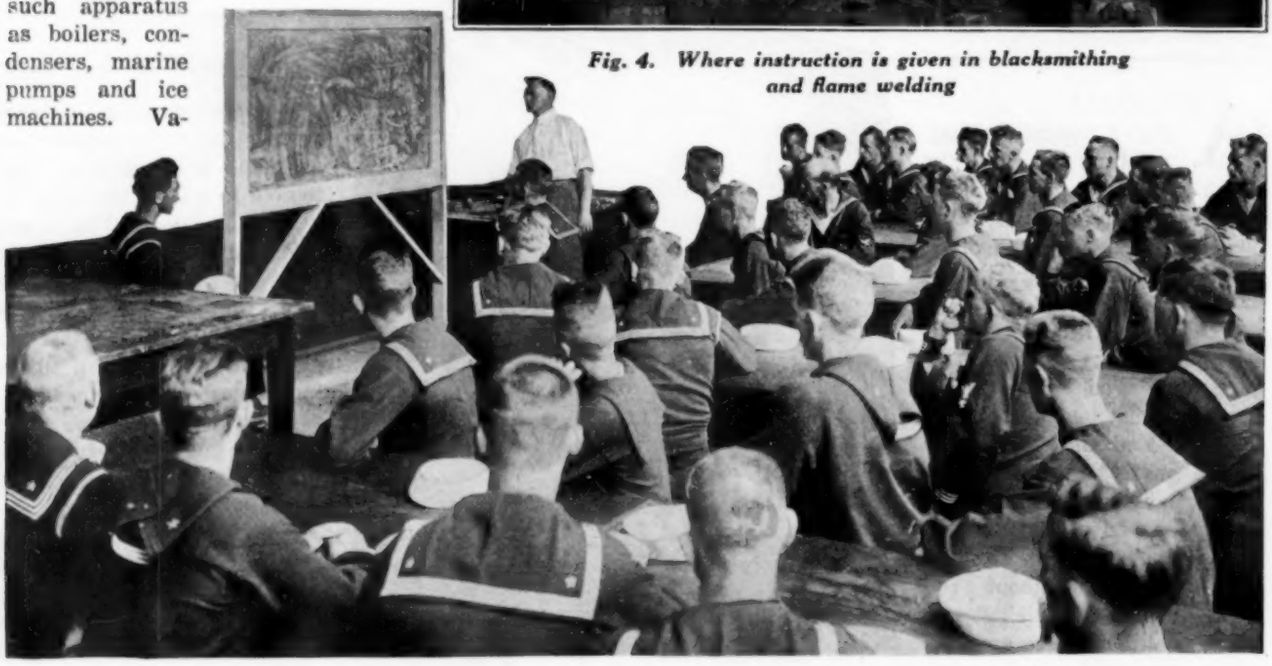


Fig. 3. The class in heat-treating and properties of metals

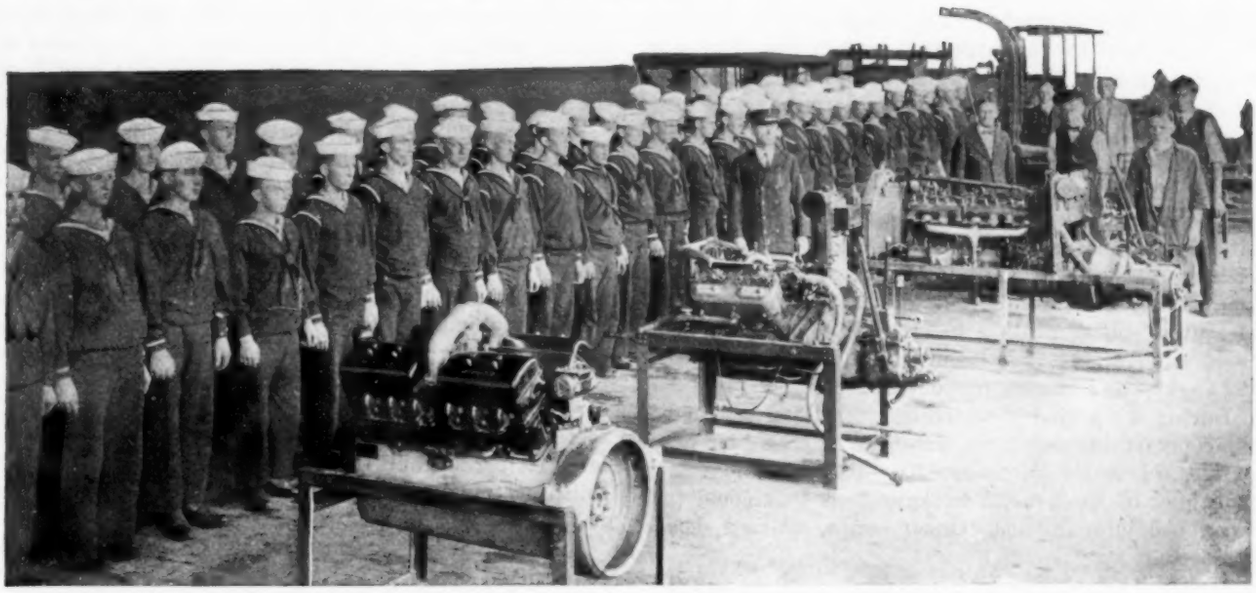


Fig. 5. Class in gas-engine work lined up for inspection

rious machine shops in the neighborhood also contributed to their training. At the railroad shops the men gained a knowledge of heavy jobs, such as work on boiler patches and locomotive frames, in order that they might be prepared at sea to tackle heavy repairs in the engine room. Fig. 1 shows a student making a repair on a large locomotive boiler.

Machine Shop Instructions

Classes were formed and the boys given instruction in bench, lathe and vise work, and on milling, shaping, planing, drilling and grinding machines. This was followed by pipe-fitting, brazing, babbitting and tinsmithing, together with machine sketching in the drafting room, mathematics and formulas in the classroom, and a series of lectures and examples in the heat treatment of metals. Figs. 2 and 3 show the classrooms.

In the carpenter shop there were about two weeks of patternmaking; then the boys took their patterns to the foundry, made and poured their molds, and returned with the castings to the machine shop to finish them. In the blacksmithing department these eager craftsmen forged ship accessories such as swivel cleats, eye pads, sister hooks, shackles, oarlocks and standard chains. In oxy-acetylene welding the men learned to repair stripped gears, shafts, cams and the like. For example, the instructor would take an old gear from a heap of scrap iron, knock several teeth off it and tell the student to weld them back with the torch. By making a special study of contraction and expansion the apprentices were taught to exercise the judgment necessary at the critical moment to make their welds hold. Fig. 4 is a view of the students at work in the blacksmith shop where instruction in welding was given.

Fig. 6. The laboratory where the boys are taught the rudiments of electricity

Before starting work in the morning each squad or class was lined up for inspection, and in Fig. 5 may be seen the class in the gas-engine laboratory where they got theory and practice in two- and four-cycle engine mechanism, including valve setting, carburetion, ignition and lubrication. Instruction was also given in steam and oil engines as well as those of the gasoline type.

Electricity was not neglected, as this is a matter of vital importance on board a battleship, and the bluejackets received therefore a rudimentary training in magnetism, electric circuits, storage batteries, current-measuring instruments, etc. (Fig. 6). In motor boats there was training in hull construction and in mounting the engines and affixing propellers.

During the period in which the men were assigned to the coppersmith shop they were taught to lay out their patterns geometrically according to the fundamental principles of sheet-metal work, so that they could turn out ventilators, funnels, bunker lamps, oil cans, hoods, flues, etc.

Carbon in Iron and Steel

SPECIAL CORRESPONDENCE

In spite of all that has been written about iron and steel there are many hazy notions in the minds of many mechanics regarding them. It is not always clear just what makes the difference between iron and steel, because we know that cast iron has more carbon than tool steel and yet it cannot be hardened to make a good cutting tool.

Cast iron has from 3 to 5 per cent. carbon, while good tool steel rarely has more than 1¼ per cent. carbon, yet one is soft and has a coarse grain, while the other has a fine grain and can be hardened by heating and dipping in water. The carbon in cast iron is what is called graphitic carbon; that is, it is in the form of graphite, which is almost pure carbon. The resemblance can be seen by noticing how cast-iron borings blacken the hands just as does graphite, while steel turnings do not have the same effect. The difference is due to the fact that the carbon in steel is not in a graphitic form and that it is present in smaller quantities. In making steel in the old way the iron-ore pig was melted and the carbon burnt out of it, the melted iron being stirred or puddled, which gives it the long grain or fibers like molasses candy which has been pulled. The iron ingot was then hammered or rolled into bars and these bars packed in layers between layers of ground charcoal and heated to a good high heat so as to open the pores of the steel for the purpose of absorbing carbon from the charcoal. This is called the blister process for making steel. If a higher carbon content was wanted the process would be repeated until the desired amount of carbon was reached.

The carbon is soaked into the steel and mixed thoroughly with the iron so that it does not segregate or form graphite as is the case in making cast iron from the pig.

A little study of malleable iron may help to understand the nature of steel and the way in which it differs from cast iron. In making malleable iron the castings are heated in a furnace to from 1700 to 2100 deg. F. and kept at this temperature from 48 to 96 hours, both the heat and the time depending on the size of the castings. This heat burns out most of the carbon, making the metal more like wrought iron. The continued heat and the slow cooling in the furnace as it cools down away from the air rob it of most of its carbon. This same thing happens to some extent with tool steels when heated for annealing. The outer skin loses its carbon and this skin must be removed before finishing and hardening if a tool with a hard surface is desired.

Malleable iron resembles wrought iron in that it is not brittle, that the castings can be bent or straightened and that it can be welded if care is used. Borax and a little sand are used for the flux. Malleable iron, however, is not to be compared with wrought iron for strength, as it is not worked by rolling or hammering as in the case of wrought iron.

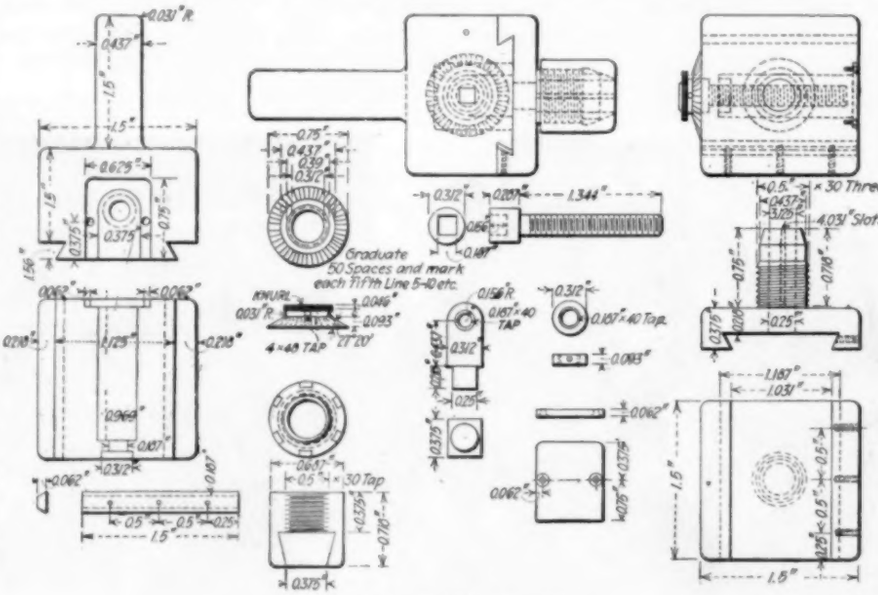
The high and continued heat leaves the metal more or less porous, but still having some of the qualities of wrought iron.

A Handy Offset Boring Head

BY ALBION SWANSON

An offset boring head small and light enough to carry in a toolmaker's kit is shown in the drawing.

The shank is made of a size suitable to be held in a draw-in collet or drill chuck, and the spring chuck that



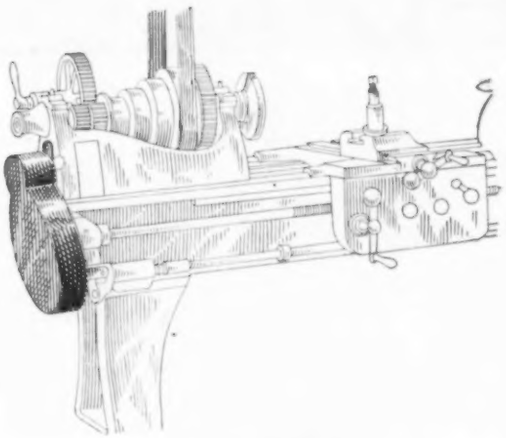
OFFSET BORING TOOL

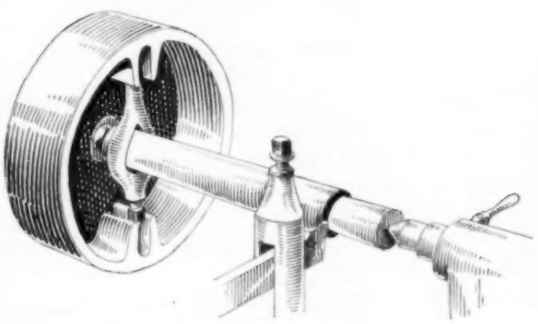
holds the boring tool is made to take ¼-in. drill rod, which is a convenient size for small tools.

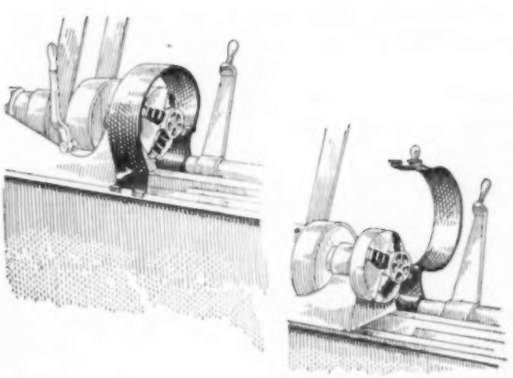
The adjustment screw carries a graduated dial for the purpose of setting the tool for a definite increase in the diameter of the hole bored.

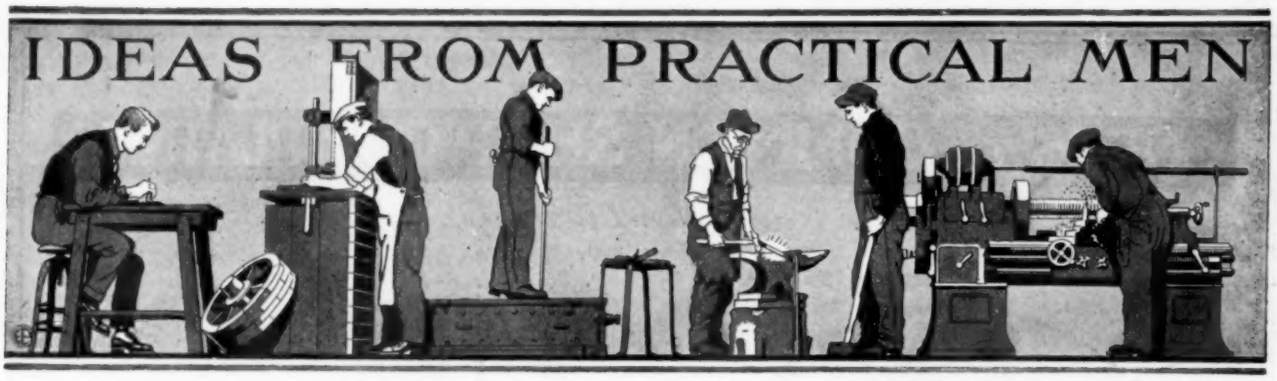
CURES *for* COMMON SHOP COMPLAINTS

By J. A. Lucas





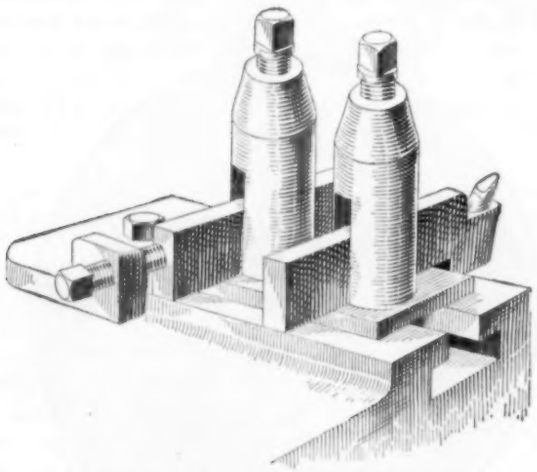




Using Two Tools at Once

By F. P. Fenaux

We have been using occasionally two tools on the same piece of work on the lathe (one tool roughing, the other finishing previous to grinding) and have had trouble in keeping the cutting edges the proper distance apart on account of the numerous sharpenings due to the hardness of the stock. We finally made the attachment shown in the sketch. It is a forging with a rib fitted to the slot of the compound rest and a projection on the end to receive a square-head adjusting screw. A bolt holds it down on the rest.



ADJUSTMENT WHEN USING TWO TOOLS

We found that it was best to adjust the finishing tool first to diameter, then bring the roughing tool up with the adjusting screw, then clamp the roughing tool solidly.

We realize that this could be improved, but in this shape it helped us a great deal.

Bending Die With Movable Anvil

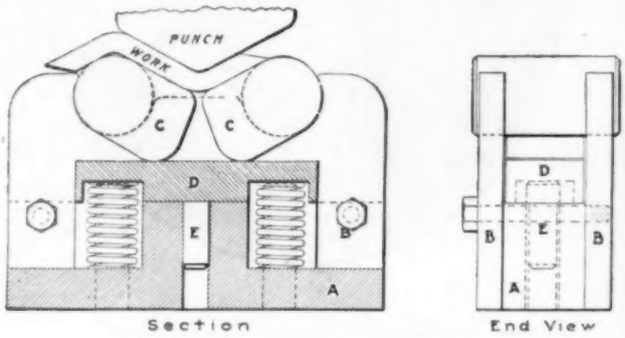
By John Chidsey

Though performing a simple operation the tools here shown and described may be of interest because of their unusual features. They are designed to form pieces of sheet copper which have already been cut to length.

Attempts to do the work with the usual forms of tools had not been successful because of the creeping and stretching of the material which would cause the bends to be out of place.

To the die bed *A* are secured the two vertical pieces *B* in which is formed the bearings for the two movable pieces *C*. The pieces *B* also serve as guides for the plunger *D*, the latter being held against side movement by the pin *E*, which is a sliding fit in the bed casting.

Heavy coil springs under this plunger hold the pieces



SHEET-METAL FORMING TOOLS

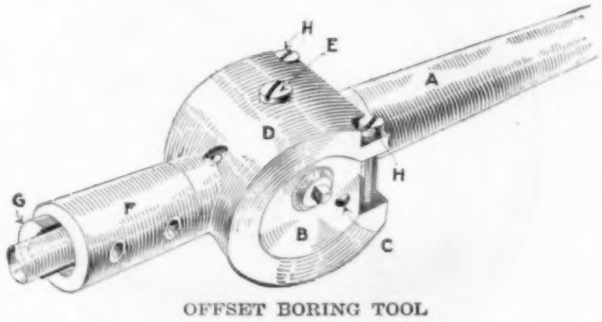
C normally in position with their upper faces in a straight horizontal line.

On this flat surface the work could be accurately located, and when the descending punch gripped the metal at exactly the right spot there was no opportunity for it to move out of place during the operation.

An Offset Boring Tool

By Leslie Eldridge

The drawing shows a tool which I have made for my own use and which I find very convenient. There are of course tools of this nature on the market, but they are more or less expensive, and many times a toolmaker prefers a tool of his own construction anyway. The tool here shown is of simple design and easy to make, but careful workmanship throughout is required if it is desired to have the adjusting screw and dial indicate accurately.



OFFSET BORING TOOL

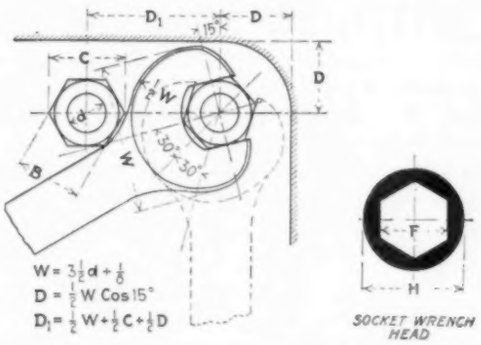
It will be noticed from the drawing that dovetails and flat sliding surfaces have been avoided as far as possible, thus making it possible to produce the tool almost entirely on the lathe, and it is for this reason that it can be made more quickly and easily than some of the others that have been shown.

The shank *A* may be made parallel or taper as desired, and the round piece *B* is bored on one side, the shouldered end of the shank fitted in and held by taper pin *C*. Part *B* has a slot milled along its upper surface to accommodate the adjusting nut which is held to part *D* by screw *E*. Parts *D* and *F* may be made one piece if desired or they may be made separately and pinned together as shown. Part *F* is bored large enough to take the half round V-block *G* in which the boring tool is seated by the two hollow-head setscrews. Screws *H* clamp the tool in position after each adjustment.

Minimum Spacing of Hexagon Nuts for Wrench Clearance

By F. H. Zeichner

The table here given enumerates the minimum spacing for wrench clearance of bolts with hexagon nuts; also the sizes for standard socket-wrench heads, diameter of spot-facing cutters, washers and other



information on bolts. The figures are especially valuable in engine design and machinery where parts must be compact but with the bolt's head easily accessible.

The information contained in this table has been very useful both to myself and to my associates and I am submitting it to you for publication in the columns of the *American Machinist* with the belief that it will prove to be equally valuable to other designers engaged in similar lines of work.

SOCKET-WRENCH HEAD—ALL DIMENSIONS IN INCHES

Bolt Dia. U.S.S. d	D	D_1	Dia. Spot Facing Cutter	Dia. U.S.S. Washer	Over Flats B	Across Corner C	Socket Wrench F	Socket Wrench H	Bolt Dia. U.S.S. d	D	D_1	Dia. Spot Facing Cutter	Dia. U.S.S. Washer	Over Flats B	Across Corner C
						0.578			2¼	3⅛	7¼	4½	4½	3⅛	4.013
						0.686			2½	4⅛	7⅞	5	5	3⅛	4.476
			1	1		0.794		1	2¾	4⅜	8⅛	5½	...	4½	4.909
						0.902		1	3	5	9	5½	...	4½	5.342
						1.011		1	3¼	5⅛	10⅛	6½	...	5	5.775
	1	2				1.119		1	3½	6	11⅛	6½	...	5½	6.208
						1.227		1	3¾	6⅜	11⅞	7	...	5½	6.641
				2		1.444		1	4	6⅝	12⅝	7½	...	6	7.074
						1.660		2	4¼	7	13⅛	8	...	6	7.508
1						1.877		2	4½	7⅜	14⅛	8½	...	6½	7.941
						2.093		2	4¾	8	14⅞	8½	...	7	8.374
				3	2	2.310		2	5	8⅛	15⅝	9	...	7	8.807
						2.527		3	5¼	9	16⅜	9½	...	8	9.240
						2.743			5½	9⅛	17⅛	10	...	8½	9.673
						2.960			5¾	9⅝	18	10½	...	8½	10.106
				4	2	3.176			6	10⅛	18⅞	11	...	9½	10.539
						3.393									
2						3.609									

Hole in washer = diameter of bolt + $\frac{1}{16}$ for bolts up to and including 1 inch in diameter.
Hole in washer = diameter of bolt + $\frac{1}{8}$ inch for bolts 1¼ to 2½ inches in diameter, inclusive.

A Machine for Boring Babbitt Linings of Car-Journal Brasses

By J. V. Hunter

For the rapid boring of the babbitt lining in car-journal brasses a special machine has been built by the Wilson Avenue shops of the Northwestern Elevated Railway Systems of Chicago, and is shown in Fig. 1.

Two sizes of journal brass in use on this system are 4 in. and 4¼ in., and in order to handle both sizes the machine is made in two units connected together, thus forming the complete device. The cylinders are of two different diameters, the one at *A* being for 4¼-in. bear-

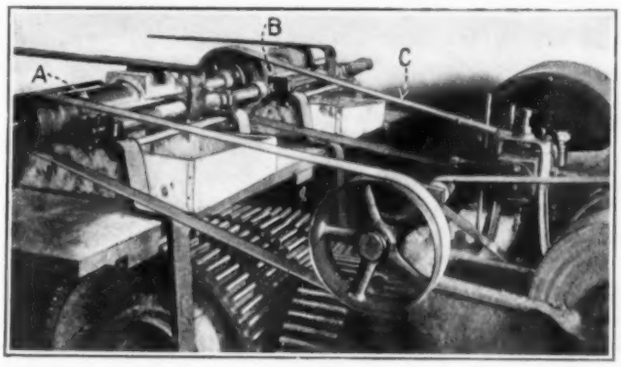


FIG. 1. MACHINE FOR REBORING CAR-JOURNAL BEARINGS

ings and that at *B* for the 4-in. bearings. Scrap pans are provided below the machine to catch the chips.

A brass, after the babbitt lining is cast in, is laid on the cylinder *A*, Fig. 2, which is driven by the belt from a motor. The arm *B* is lowered onto the brass so that the prongs *C* lock into the notches provided on the back of the brass for the locking wedge. Pressing down on the lever the operator slides the brass across the gap *D* onto the cylinder *E*, which is slightly larger than *A*. In its passage across *D* the cutting tools *F* bore out the soft metal to a diameter corresponding to that of cylinder *E*. The action of the machine is somewhat analogous to that of a jointer in which a piece of wood is planed by passing it from a lower table to a slightly higher one across a gap in which is the rapidly revolving cutter.

A uniform rate of feed is obtained by means of a screw on a continuation of the shaft to the left beyond the bearings. This screw has a lead of $\frac{3}{8\frac{1}{2}}$ in. The handle *G* has a half nut on its upper face, which fits

into this thread on the shaft, and when starting to make a cut the operator raises the handle until the half nut is in contact with the thread and is carried forward by it. The two handles are so fastened as to allow independent movement around the shaft *H*, which is free to slide longitudinally in its bearings; but the handles

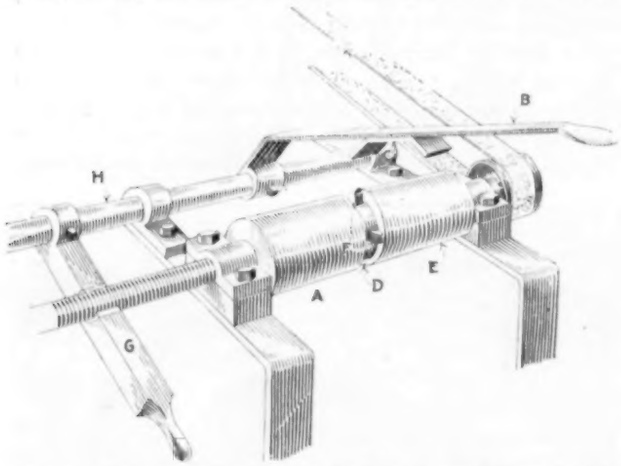


FIG. 2. DETAILS OF BORING MACHINE SHOWING FEED ARRANGEMENT

cannot move lengthwise on the shaft, therefore when lever *G* is moved forward by the thread, lever *C* carrying the brass moves with it.

The machine is always ready to operate, so when a workman takes out a journal brass and finds it badly worn at one end but still serviceable if re-dressed he takes it directly to the machine. This is so simple in its operation that almost any workman can soon learn to operate it.

The cut obtained shows noticeable toolmarks, but it is claimed that this condition is not detrimental and that a run of a few miles on the road gives the metal a chance to work down to a good bearing.

The shops state they have obtained a considerable saving in the amount of babbitt used since the installation of this device.

Boring Bar With Recessing Tool

BY L. JAGOW

The size and shape of the work to be done in this particular case called for the use of a boring mill, as most of the operations could be done in this machine without special tools. The best way of holding the

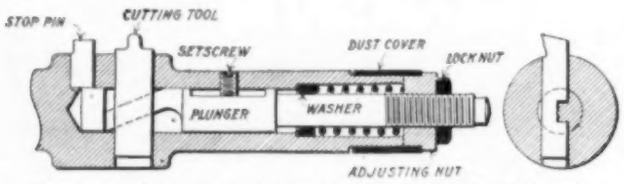
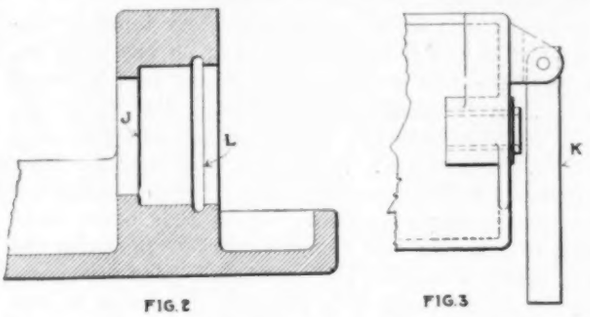


FIG. 1. ASSEMBLED SECTION OF BORING BAR AND RECESSING TOOL

casting in the fixture required that the end where the recess *L*, Fig. 2, had to be cut be away from the head of the machine. To cut this recess a special boring bar and recessing tool were made up as shown in Fig. 1.

After the bar is in position in the fixture it is set by bringing the stop pin against the shoulder *J*, Fig. 2, thus insuring accurate location of the recess.

With the bar in motion the lever *K*, Fig. 3, which is part of the fixture, is brought to bear against the end of the plunger, Fig. 1. As this is pushed in, the tongue on the inner end of it which fits in a groove in the under side of the cutting tool forces the latter



FIGS. 2 AND 3. PART SECTION OF WORK AND FIXTURE
Fig. 2—Section showing groove to be cut. Fig. 3—Fixture with operating lever

outward until the nut comes against the end of the bar. The tongue and groove are cut at a 20-deg. angle. The depth of the cut may be governed by means of the adjusting nut.

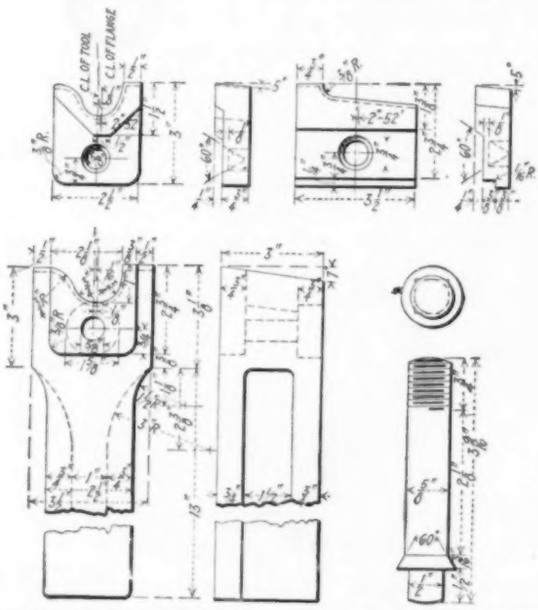
When the cut is completed and lever *K*, Fig. 3, is released the spring, Fig. 1, returns the plunger and withdraws the tool.

A Heavy Forming Tool

BY J. LONG

The drawing shows one of a number of forming tools used for turning the treads and flanges of wrought-steel car wheels.

The holder is made of axle steel, is channeled out on the sides to reduce the weight without sacrificing



HEAVY FORMING TOOL USED ON CAR WHEELS

strength, and is pocketed at the business end to hold the cutter, which is fastened with one or two screws according to the width of the tool.

The screws are special, with a head somewhat like a patch bolt, and serve to draw the cutter tightly against the walls of the pocket.

Re-education Vs. Disability Compensation

By DOUGLAS C. McMURTRIE

Director Red Cross Institute for Crippled and Disabled Men, 23rd St. and Fourth Ave., New York

In the past our method of dealing with men permanently disabled in the course of employment has been to pay the worker a pension in the form of compensation and forget him and his injury. But the cost of disability in the machine-tool industry has not been only in premiums paid for casualty insurance. There has been the cost involved in the training, experience and adaptation of a skilled worker who does not return to his job and the fitting of a newcomer to take his place.

THERE are three means of reducing and approaching the complete elimination of the cost of disability: First, accident prevention; second, thorough medical attention to minimize the disability resulting from the injury, and third, salvage of the remaining abilities of the worker through rehabilitation for self-support. The first of these has already received wide attention from employers and has wisely been encouraged in a financial way by casualty-insurance companies and state funds. The importance of the other two has, however, not as yet been appreciated. Their energetic application would effect a tremendous saving to industry.

Many injuries from which men would completely recover in a short time under adequate medical attention are treated for an insufficient time or by incompetent physicians, and instead of a prompt return to work the case at best drags along over an extended period and at worst becomes chronic or develops into permanent disability. Some states require the insurance carrier to provide but two weeks of compulsory free medical attention to the injured man. For the insurance company to take advantage of this limitation is a most short-sighted policy, because for every dollar saved in physicians' or hospital fees the insurance carrier later pays out ten in compensation. And what the insurance company pays comes out of the regular premiums paid by the insuring employers.

High-Grade Medical Attention

Unlimited medical attention of the highest grade should be an axiom of casualty practice and it should be insisted upon by employer and workman alike. The best outcome of any injury is to have the employee return to his job as a well man in the shortest possible time. It is well to develop a science of dealing with cripples, but the ideal is to have fewer and fewer cripples with which to deal.

The third method of attack on the cost of disability is rehabilitation for self-support—the reëducation of an injured man for an occupation he can follow or a process he can perform in spite of his handicap. The science of rehabilitation is new and the experience in it has practically all been gained in the effort to make sound and just provision for the disabled soldier or sailor. Every country among the recent belligerents is today operating a comprehensive system of reëducation for disabled soldiers, and is placing upon that system more dependence than upon the pension system.

Paying a man a small monthly or weekly stipend on which he is expected to live in idleness is not a very constructive method. With the breakdown of confidence in the pension system it was realized that the only real compensation for disablement was restoration of capacity for self-support. It was further realized that very few jobs require all the physical faculties and that with the present-day variety of industrial processes it is possible to find a job in which a man with a given type of disability can function 100 per cent. efficiently. Some jobs require standing, some sitting, and others walking about; some jobs at a bench working on small articles require but little strength, others involve great physical exertion; still others do not require the sense of hearing; in others the sense of sight is not essential. Finding the future work of the disabled man therefore requires expert and painstaking choice, but a successful selection is possible even for the seriously handicapped. The first aim is to place the man back in a different job in his own trade or in a trade closely related. In such a job his past experience will stand him in good stead. Failing this he must be retrained for a different line.

Trades Being Taught

The process of retraining the disabled is known as reëducation, and can best be accomplished in a special school for crippled men. The first school of this kind in the United States is the Red Cross Institute for Crippled and Disabled Men established in New York through the generosity of Jeremiah Milbank. At this school, open to disabled civilians and soldiers alike, six trades are already being taught—artificial-limb making, motion-picture operating, oxyacetylene welding, printing, jewelry work and mechanical drafting. More will be added as the demand develops. Graduates are already giving satisfaction in the jobs for which they have been prepared, so the enterprise has passed the experimental stage. And in the results attained with disabled soldiers abroad there is overwhelming evidence of the logic and practicality of rehabilitation.

The cost of soldier rehabilitation is being met by the United States Government and by the governments of some of our allies. It will be admitted without argument as desirable that the advantages of reëducation be made available to disabled civilians as well, but will not the cost be prohibitive? The fact is that rehabilitation effects a reduction rather than an increase in the cost of disability to industry or to the community as a whole.

A typical case will illustrate how the saving is effected. A worker in Massachusetts was injured by a fall while working inside a submarine and his hand became permanently crippled. In due course his compensation rate was determined and he was referred to the insurance carrier to be paid $10 a week for a long period, with a maximum total payment of $4000. Since

the disability was manifestly permanent the insurance company wrote the case off their books as a $4000 loss and transferred that amount to reserve to cover the weekly payments. After the compensation had been paid for nearly a year a new official of the insurance company began looking over the list of men to whom the company was paying compensation. His attention was directed to the man in question and the latter was requested to call at the office of the company. The case was, like many thousands of others, susceptible of rehabilitation for self-support, so the insurance company's official put a proposition to the man in very frank terms: "I believe that you can be trained to earn a good living. I want you to understand very clearly, however, that this proposal is to the financial advantage of the company, but I also believe it is to your advantage as well. A total income of $10 a week is not very attractive to you and you would probably rather return to work at a good wage than remain idle. If you will consent the company will send you to a school of reëducation and see if it cannot get you back on your feet in good shape."

Reëducation at Red Cross Institute

The injured man consented to the proposal and the company sent him to the Red Cross Institute in New York. It began to pay him not $10 a week as required by law, but $40 a week, $20 to him in New York and $20 to his wife at home. The company also paid liberally his traveling expenses in both directions. In the period of eight weeks he was reëducated in oxyacetylene cutting and welding and returned home. He is now making not only a satisfactory wage but twice as much as he had ever earned before.

In the whole transaction every party at interest was benefited. The man was advantaged in that his general living standard was distinctly raised and the necessity of working for his living could not be considered as a hardship. The company paid less than $500 for his rehabilitation, and this expense in conjunction with the $500 already paid in weekly compensation during the first year of idleness made a total for the case of $1000. It was thus enabled to charge $3000 of profit to the account of profit and loss. The community was infinitely the gainer in that the man, formerly an unproductive consumer, became a useful producer instead. The community further gained in the elimination of the disabled man from the category of a prospective dependent, because while compensation might have taken care of him in a very insufficient way during the period of idleness there would have come a time when compensation ceased and then he would have been in a desperate economic condition indeed—confirmed in habits of idleness, untrained for skilled work and almost invariably with no means of support.

A more intelligent handling of disability by insurance carriers will therefore reduce their expenses and cut the cost of casualty protection to the employer. There is needed also, however, some revision of the compensation laws so that there may be definite encouragement to insurance carriers to offer opportunity of rehabilitation and definite encouragement to the disabled men to take advantage of it. Practically every compensation case that has ever come to the Red Cross Institute has come on the day compensation expired. For one year, for two years or for four years the man has existed in idleness, drawing compensation and cultivating habits of indolence. When his support was cut off he then became interested in rehabilitation. Present compensation legislation tends to encourage the man to remain idle because his payments are reduced by any improvement in earning capacity. A revision of this practice will make for more constructive provision.

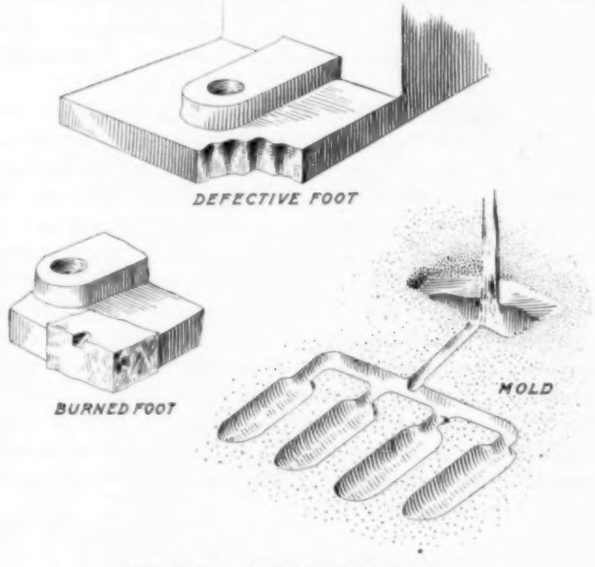
In short the first effort should be to prevent injury, the second to minimize its permanent effects, the third —when disability has ensued—to offset its economic consequences. The execution of this complete program is sound humanitarian practice and good business.

Repairing Defective Castings

By Frank Calkins

Previous to the advent of the oxyacetylene torch many an otherwise good casting was relegated to the scrap pile on account of a shrinkage crack or other defect in some vital part. Some foundries, however, resorted to the process called "burning," a method that can be profitably employed in foundries the equipment of which does not include the oxyacetylene apparatus, and thus save many castings at a fraction of the cost of remolding.

Let us take the case of a dry-sand-molded steam-cylinder casting, which because of trouble with a core was cast with a defective foot. To reclaim this cast-



BURNING A DEFECTIVE CASTING

ing the edges of the defective part were carefully cleaned and the casting placed on the foundry floor where all surfaces adjacent to the defective foot were covered with "heap" sand. A mold was then cut out a trifle larger in dimensions than the portion of the casting to be replaced and the mold provided with a runoff leading to pig molds so that no metal would be wasted.

Two 200-lb. ladles of metal were required to burn on the part. The molten metal was slowly poured against the edges of the defective part, which soon softened and fused with the metal in the mold. The repaired part did not present an appearance of which the molder could be proud, but after a little chipping the casting was made as serviceable as if no trouble had been experienced in the original cast.

US
ARMY ORDNANCE NEWS

A GENERAL order issued from the War Department on Feb. 13, 1919, states that "By order of the President the Distinguished Service Medal is awarded to the following named officers and civilians for exceptionally meritorious service to the Government in a duty of great responsibility: . . .

"Brig.-Gen. William S. Peirce, U. S. Army, for exceptionally meritorious and conspicuous service. While in charge of the Springfield Arsenal his exceptional ability contributed materially to increasing the output of small arms. As assistant Chief of Ordnance he has rendered conspicuous service."

William S. Peirce

Brigadier General, United States Army
Assistant Chief of Ordnance

General Peirce was born in Burlington, Vt., on May 16, 1864. His father was Albert G. Peirce. He attended the local schools and graduated from the Burlington High School in the spring of 1881. The next fall he entered the University of Vermont and completed three years of the course. In the summer of 1884 he was appointed to the United States Military Academy and left college to enter West Point in the fall. He graduated in 1888 and was appointed to the artillery.

After four years in this branch of service he was transferred to the Ordnance Department and stationed at Watervliet Arsenal. His next post was at the Sandy Hook Proving Ground, and this was followed by tours of duty at two arsenals, namely, Rock Island and Springfield.

He was for a time Inspector of Ordnance at New Haven, Conn., and later stationed at the plant of the Midvale Steel and Ordnance Co. He went on duty in the office of the Ordnance Department in Washington in May, 1909, and remained there until September, 1912, when he was given command of the Springfield Armory. He held this position at the outbreak of hostilities and retained it until January, 1918. Since that time he has been in Washington, as chief of the Administration Division, where he did splendid work in directing the handling of personnel, construction of new buildings and other administration details, and later as assistant Chief of Ordnance, a position which he still holds. In view of the fact that most of the citations have gone to the oversea forces it is pleasant to record the decoration of some of the men who did the hard work on this side of the water without having an opportunity to share in the glory and the stimulation of combat duty. Without doubt the honor is well-merited, although the men who did the work would probably be the last to admit it.

In the following pages General Peirce tells how Army ordnance met its responsibilities. Every reserve or regular ordnance officer and every manufacturer who has had anything to do with the fulfillment of ordnance contracts will be interested in reading this account written by one who has been in such close touch with the history of ordnance activities during this war and who also has a knowledge of ordnance activities in years past. General Peirce describes how tremendous obstacles were met and overcome.

ARMY ORDNANCE NEWS

How Army Ordnance Met Its Responsibilities

By BRIG.-GEN. W. S. PEIRCE
Assistant Chief of Ordnance

This is the story of the big work done by the Army Ordnance Department in the great war, written by one who believes that it is time for the American public to know the whole truth about a subject that until now has not been fairly presented to them.

ARTICLES on the Ordnance Department which have been hitherto published in some papers have usually dealt with only such portions of the work as the writer's thought offered a chance for sensational criticism. They have contained so many part truths, so much false emphasis, special pleading and misrepresentation of facts that the public has been led to believe the Ordnance Department of the Army failed miserably in its task. This impression is false. The Ordnance Department did not fail; on the contrary its performance of its allotted portion of the gigantic national effort is a record of which every American can be justly proud. Every ordnance officer who, smarting under the undeserved criticism of the past year, has steadily kept at his work, believes that the American people are essentially just and need only to have the truth about ordnance presented to them to give the credit and praise that the work really deserves.

TANK TAKING A REST

What then was the Ordnance Department's job? Briefly it was to furnish the American Army with the fighting equipment that it needed and to maintain and repair the equipment in the field.

Next, how successfully was that job accomplished? That question is convincingly answered in a letter from Lieutenant-General Liggett, commanding the First American Army in France, who said that the American troops were well and thoroughly equipped and that no military operation was prevented or delayed by lack of supplies of any sort.

Fighters Satisfied

So the Ordnance Department performed its job to the satisfaction of the fighting troops and it believes that the American people once they know that fact will accept the verdict of that jury against any other.

Where it got the needed equipment—whether it was from France, England or this country—matters little. The big outstanding fact is that it got it and delivered it as fast as the men really required it. It is true there were some close shaves and some sharp corners around which the machine skidded dangerously, but it never overturned. The work is now done; the record made, and the only reply that the department need make to those swivel-chair critics who charge it with failure in this or that particular is, "Ask the A. E. F."

It is not claimed that the department made no errors. There was a tremendous task to perform with a hastily assembled personnel working feverishly against time. Approximately half of the total appropriations for the War Department were for ordnance. It had to plan and place orders for equipment costing in round numbers $16,000,000,000. It had to arrange for the enlargement of old plants and the building of new ones costing $500,000,000. No other business in the world ever dealt in such figures. Of course, errors were made; it was inevitable they should be if action and progress were to be made. But those that were made were corrected or overcome and so did not prevent the successful completion of the job as a whole. At the beginning of the war the Ordnance Department had fewer than 100 officers and approximately 750 enlisted men. Of the fighting equipment which it had to provide there were on hand not more than 600,000 infantry rifles; less than 500 field guns, with only a small amount of ammunition; not enough infantry pack carriers for the Regular Army and National Guard; less than 2000 machine guns; no tanks; no large field guns such as had been developed and used abroad, and what was almost as bad no adequate facilities for the manufacture of these articles in the quantity required.

Equipment for 4,000,000

That greater quantities of these things were not on hand was not the fault of the Ordnance Department, but of the American people, who in spite of the appeals of the department in past years had not insisted that their Congress appropriate the money required to get them. With supplies generally inadequate for the field operations of even the small Regular Army the Ordnance Department was confronted with the task of providing equipment first for an army of a million, then of two million and finally of nearly four million men.

And bear this in mind, ordnance equipment is not kept in stock except by governments. You cannot go out and buy it at the corner store. Nor is most of the machinery and tools used in commercial work adaptable to ordnance work. The same yarn that is used in civilian clothes can be dyed khaki color and woven into uniform cloth by the same looms that only yesterday stopped their ordinary work. But a machine shop or factory cannot be turned to ordnance work without long preparation. War has become more and more a mechanical affair fought and carried on by the use of

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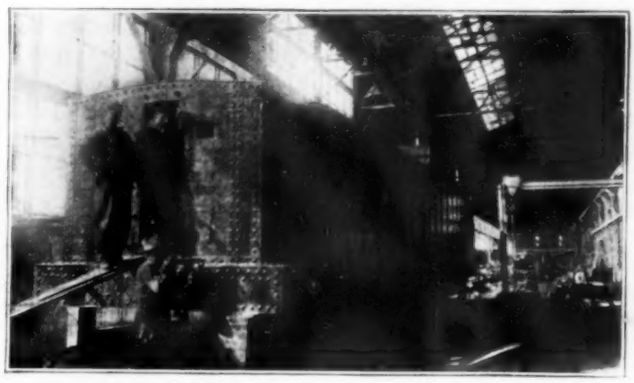
machines. These machines are special, different from any made in peace time, are increasingly expensive and require time, time and still more time to produce. It takes nine months to make a large gun in a factory already equipped and experienced in the work. Even with rifles and the smaller articles the special equipment in the way of fixtures, tools and gages requires a surprisingly long time to provide, and until this factory equipment is procured the manufacture of the article in quantity cannot be begun. How much this time of beginning is prolonged can be imagined when the factory has first to be built and the machinery for it made. This was the job that in April, 1917, faced the little body of less than 100 regular officers that constituted the Ordnance Department at that time. It had to expand its own force while undertaking at the same time the work for which it needed the whole strength that it finally obtained. How did it meet the problems? It called to its aid from civil life the best business, professional and technical talent that it could get. It increased its number of officers from less than 100 to nearly 6000 and its enlisted personnel from about 750 to 63,000. Anyone in business can imagine to some degree what such an expansion of an organization means when accomplished in little over a year. If the department had not been able to obtain so many men of high executive ability and business experience this hasty assemblage would have resulted in confusion worse confounded instead of achieving the general efficiency that it did.



RIVETING AN ARMORED CAR

The Reserve Officers

Too much emphasis cannot be laid on the quality of Americans who responded to the call of the Ordnance Department. Men who were conducting the largest business enterprises or who were at the top of their professions, engineers, chemists, lawyers, laid down their private affairs at great personal sacrifice to assist in this work. Younger men who were experts in some needed line or who were not physically fit for field duty came also to do their part.

If such a group of men could not put over the job successfully, from what source would it have been possible to get men who could? They worked nights and Sundays, frequently under a fire of criticism and sarcastic comment more difficult to endure than that from guns. They were called "slackers" and "desk warriors," and their right to wear the uniform was questioned by many whose only visible war effort was the systematic depreciation of these loyal workers. Orders were placed abroad in factories that were ready to produce war material; new factories were started in this country; workmen were assembled and trained in the new work of producing ordnance material on a scale never before dreamed of. Delays were encountered, heart-breaking delays, due to insufficient transportation, lack of needed materials, tools and skilled labor. Expectations and promises of production repeatedly failed to materialize. But foreign deliveries bridged the gap as anticipated and production finally increased in volume here, so that when the armistice was signed it was advancing at such a rate that before it could be checked there was produced more equipment of almost every item than would equip and maintain two armies in the field for six months.

The men who made success in this great work possible are now returning to civil life. They wear no medals or decorations, but remember this, if they had not done their work well and thoroughly there would have been no medals won by Americans in France. They were an honorable part of the war machine of which America is now so proud. It is only common justice that the truth about ordnance should be widely known, so that their fellow townsmen can accord these men the credit they so richly deserve.

The Army ordnance has been criticised for much and praised for nothing. It has been charged with failure because it did not get artillery and ammunition from America where the utmost efforts of manufacturers could not produce it in time, and also for getting it in France and England where it could be produced in time. It will be asked how could these countries spare any of the guns and ammunition they were making. The answer is that in the great effort they had made to equip their large armies in the shortest possible time they had developed manufacturing capacity much beyond that required to keep these armies going after they were once equipped. Every gun and carriage that could be made abroad saved tonnage space in a ship, space that was urgently needed. So placing orders abroad not only got the articles sooner but saved ocean-carrying capacity, and our troops, which the French and British so badly needed, were able to get into action in 1918 instead of waiting for the guns and shells which it was not expected America could produce until 1919.

Ordnance Department Worked in Harmony with Manufacturers

The Ordnance Department could not of itself produce these things. It had to work with the manufacturer at home and abroad. It could and did direct, encourage, assist and urge forward the industrial effort, but in the last analysis actual production depended on the energy, skill and resources of the manufacturer. In spite of all obstacles it made good; it got the stuff. That is all the people will want to know before joining with the A. E. F. in pronouncing judgment on ordnance.

ARMY ORDNANCE NEWS

Work of Aircraft Armament Section Highly Recommended

What the Aircraft Armament Section has done is well indicated in the following communication from Col. H. Dunwoody, Assistant Chief of Air Service, to the Chief Ordnance Officer of the American Expeditionary Forces:

"I desire to take this opportunity of expressing to you my appreciation of the able and efficient work of the Aircraft Armament Section, Ordnance Department. This section has been associated with the Air Service for over a year, and during that period their work at all times has been exceedingly satisfactory to myself and to the Air Service. It is felt that without the energy, loyalty and devotion to duty shown by this section it would have been impossible to put combat planes on the front.

"They have been confronted with many difficult situations and have met and overcome their difficulties in a highly commendable manner. I believe it is the general impression throughout the Air Service that the Ordnance Department has rendered us valuable and efficient service.

"From a supply standpoint there has never been a single delay in equipment of planes or mobilization of squadrons due to a lack of airplane ordnance nor to a lack of competent men to install it for us. This is also true of military operations. The experience gained by this section has been of great value to the service in general, and has provided us with a large amount of valuable information which it is felt will not be lost to the service and which is exceedingly difficult to obtain from other services. I believe that our Aircraft Armament Section has shown by far greater ability than the corresponding sections of the allied services. At any rate we have covered in an armament way in one year the ground covered by the allied forces during their whole war experience, and in many items of armament I believe that we have surpassed them in efficiency. This is due to the efforts of the Aircraft Armament Section alone, and I desire to congratulate you upon the efficiency with which this work was undertaken and carried out."

PERSONALS

Capt. H. K. Benson was professor in chemistry at the University of Washington.

* * *

Lieut.-Col. James G. Scrugham is a consulting engineer. His home is in Reno, Nevada.

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Capt. B. S. Lawyer was formerly with the Ætna Explosives Co., 120 Broadway, New York.

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Capt. George Zuin of Somerset, Va., who was recently discharged, had served over fourteen months.

Capt. H. E. R. Barton was formerly sales engineer of J. Edward Ogden Co., 147 Cedar St., New York.

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Capt. George E. Morrissey of New York, who was formerly in the export business for himself, has been discharged.

* * *

Maj. Leon W. Chase was professor of engineering at the University of Nebraska. He entered the service in May, 1918.

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Lieut.-Col. James S. Dacosta before entering the service was with the Alvey-Ferguson Co., Cincinnati, Ohio, on mechanical engineering work.

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First Lieut. J. B. Renwick, Jr., was in the service over 13 months. In civil life he was employed by the Edison Storage Battery Co., Orange, N. J.

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Second Lieut. Ernest F. Schimpeler, who was formerly a civil engineer employed by the Carnegie Steel Co. at Youngstown, Ohio, has been discharged.

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Capt. John M. Price, whose home is in Lakeville, S. C., was with the Bethlehem Steel Corporation as special sales representative at the Chicago and St. Louis offices.

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Capt. Harry W. Eisenhart, who was employed by the Frick & Lindsay Co., Pittsburgh, Penn., as a steel salesman before entering the service, was discharged on Jan. 31.

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Capt. George R. Gage, who entered the service as a first lieutenant in November, 1917, was a structural-steel designer with the Electric Bond and Share Co., 71 Broadway, New York.

* * *

Second Lieut. William W. Tinsley was recently discharged. His home is in Birmingham, Ala., and before entering the service he was employed as chemical engineer by the du Pont Powder Company.

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First Lieut. Harold L. Jillson entered the service in July, 1917, as an enlisted man and was twice promoted. Before enlisting he was a salesman with the Air Reduction Co., 120 Broadway, New York.

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First Lieut. Charles L. Lowell, formerly of the Lowell-Moore Hardware Co., Fort Collins, Colo., has been discharged. He had been in the service over 11 months and is to return to his former business.

* * *

Lieut.-Col. Francis Le B. Robbins, Jr., who was discharged on Jan. 30, served nearly a year and a half. He was twice promoted. He is a lawyer and was a member of the firm of Winthrop & Stimson, New York.

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Second Lieut. James H. Lee was formerly special agent with the Pennsylvania Railroad at Philadelphia, Penn.

* * *

Second Lieut. Raymond F. Mitten, recently discharged, was with the Rock Island Plow Company, Rock Island, Illinois.

* * *

First Lieut. Alexander W. Limont before entering the service was with E. L. Fletcher, Bridgeport, Conn., as mechanical engineer.

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Second Lieut. Harold J. Smith had been in the service over a year at the time of his discharge. He is a metallurgical engineer.

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Capt. Roy E. Lynd, who was formerly with Richardson & Boynton Company, Dover, N. J., as mechanical engineer, has left the service.

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Second Lieut. Charles D. Wessels has left the service. He was formerly with the Wessels Company, Cleveland, Ohio, as mechanical engineer.

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First Lieut. David L. Babcock, a mechanical engineer, has left the service. He was formerly with the San Francisco-Oakland Terminal Railways.

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Capt. L. H. Schwarzenberg, who has served nearly fifteen months, is a structural engineer and was with Christian, Schwarzenberg & Gæde, Cleveland, Ohio.

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First Lieut. William R. Snyder was with the Fulton Bag and Cotton Mills, Atlanta, Ga., as mechanical engineer before being commissioned in September, 1917.

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First Lieut. John M. Quaintance entered the service Nov. 22, 1917, as Second Lieutenant. He was formerly with the Northern Ohio T. & L. Company, Akron, Ohio.

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Second Lieut. Laurence A. Baldwin entered the service nineteen months ago as an enlisted man. In civil life he was employed by Smith Houser of New York City.

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First Lieut. Ralph W. Kempsmith, who was discharged after thirteen months' service, was with the Bethlehem Steel Corporation at Cleveland, Ohio, and will return.

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First Lieut. Clayton H. Alvord was discharged on Feb. 15. Before entering the service he was with the Bosch Magneto Company, Springfield, Mass., as mechanical engineer.

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Lieut.-Col. Oliver S. Lyford entered the service as Major in November, 1917. He was previously assistant to vice president of New England Westinghouse Company, Springfield, Mass.

First Lieut. H. J. Williams has been discharged after fifteen months' service. He is a mechanical and consulting engineer, and was also on the teaching staff of Pratt Institute, Brooklyn, N. Y.

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First Lieut. Myron McK. Smith, discharged after twenty-one months' service, was purchasing agent for the New England Westinghouse Company, Springfield, Mass., before being commissioned.

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First Lieut. Lawrence S. Sheldrick entered the service as Second Lieutenant in January, 1918. He was formerly employed by the Timken Axle Company, Detroit, on experimental engineering work.

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Capt. Aurin E. Payson of Somerville, Mass., was discharged Feb. 14. He was with J. H. & C. H. Eagle, 265 Fourth Ave., New York City, before entering the service in October, 1917, as First Lieutenant.

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Capt. Carl H. Lambert entered the service in September, 1917. In civil life he is a mechanical engineer and was employed by Primza, Inc., New York City. He was once promoted, and is now back in civil life.

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Second Lieut. Robert Howarth, who entered the service as an enlisted man and earned his promotion, will resume his work as treasurer of Howarth, Hawkinson Company, Utica, N. Y., miners and shippers of bituminous coal.

* * *

Lieut.-Col. Herbert W. Alden has been discharged. Before entering the service he was with the Timken Axle Company, Detroit, as mechanical engineer. He was in the service about twenty months and his original commission was as major.

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Capt. Owen M. Whittenberger was discharged after over seventeen months' service during which he was once promoted. He is a mechanical engineer and his home is in Cleveland, Ohio. He was formerly employed by Seagrave & Company, Columbus, Ohio.

* * *

Capt. Thomas R. Davies has been discharged. In civil life he was with W. R. Grace & Company, 7 Hanover Square, New York City, as mechanical and construction engineer and had charge of important work in Chile. He was in the service nearly sixteen months and was promoted from First Lieutenant.

* * *

Maj. Paul Bigelow, who formerly held a commission as Senior Lieutenant in the North Carolina Naval Artillery, has been discharged from the Artillery Ammunition Section of the Engineering Division, Ordnance Department, where he was executive assistant to Lieut.-Col. Alton S. Miller at Washington, D. C. He has resumed business at 39 Cortlandt St., New York, where he has been representative of the Buckeye Engine Co. since 1901 and for the Murray Iron Works Co. for the past several years.

Bliss Flat-Edge Trimmer for Sheet Metal

SPECIAL CORRESPONDENCE

The machine here described is believed to be the only machine on the market that will trim the scrap from metal stampings and leave a smooth, flat edge suitable for soldering, welding, brazing or other operations.

IN practically all cases stampings or drawn shells produced by the ordinary power press have to be put through additional trimming operations to remove the flash, or scrap, before they can be used, and this is a process that has been more or less unsatisfactory and has caused much trouble in many cases, particularly where it is necessary to leave the edges of the finished stamping in an approximate plane.

In work where it has been necessary to join two or more of these pressed-metal parts by welding, soldering or similar operations it has been customary to follow the trimming operation by filing or grinding operations to produce the flat surfaces necessary. A fillet of any size at the point where the scrap is trimmed has of course been a decided disadvantage, and it has been the general custom to use dies with edges as sharp as possible in order to avoid this, and these have introduced difficulties in drawing. Another disadvantage has been that in working the precious metals considerable valuable material has been lost in the filing or grinding operations.

With a view to overcoming some of these disadvantages and troubles the E. W. Bliss Co., Brooklyn, N. Y., has recently developed and placed on the market the No. 702 flat-joint trimmer that is particularly adapted to trimming the flash, or scrap, from articles where the line of juncture between the scrap and the stamped or drawn body is in a single plane, so that a flat surface is produced on the edge of the stamping or shell when the stamping is trimmed. The work as delivered from the press is in condition for uniting by soldering or welding and requires no further treatment before either of these operations is performed, the flat surfaces on the edges of the material being approximately the same width as the original thickness of the sheet metal.

During the trimming operation the stamping is held in a female holding die, while the inside of the stamping up to the level of the top of the female die is filled by a filler of ordinary babbitt or some similar metal that is of the approximate shape of the inside of the stamping. After the stamping and filler are in place in the holding die the cutting die fastened to the ram descends into place inside of the stamping, and front-and-back and side-to-side motions of the holding die in the plane of its upper surface cut away the scrap with a direct shearing action, leaving the edges of the stamping in a plane and of the same approximate width as the thickness of the original material.

Figs. 1 and 2 show front and back views of the press, respectively, while Fig. 3 shows the general construction and mechanism used to operate the die in two straight lines at right angles to each other. The shell to be trimmed is supported in the lower, or holding, die *A* that is made with an opening corresponding to the shape of the stamping at the point to be trimmed. After the stamping is in place, the upper, or cutting, die *B* is brought down into operative position with its lower surface in the plane of the top of the holding die *A*. The cutting die *B* has a contour somewhat irregularly conforming to the outline of the surface to be trimmed, but is slightly smaller in size and wholly inside of the shell, so that the trimming or shearing operation shall be from the inside out. A relative movement is now produced between the holding and cutting dies that is sufficient to cause the cutting die to pass over all parts of the surface to be trimmed in a direction extending from the inside to the outside of the stamping. This relative movement is accomplished by moving the holding die to both sides and back and front, the movements being in straight lines at right angles to each other. These four movements in two perpendic-

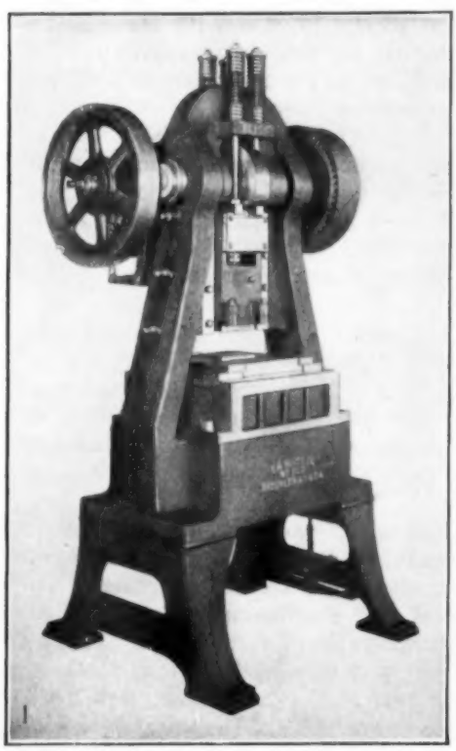


FIG. 1. FRONT OF TRIMMING PRESS

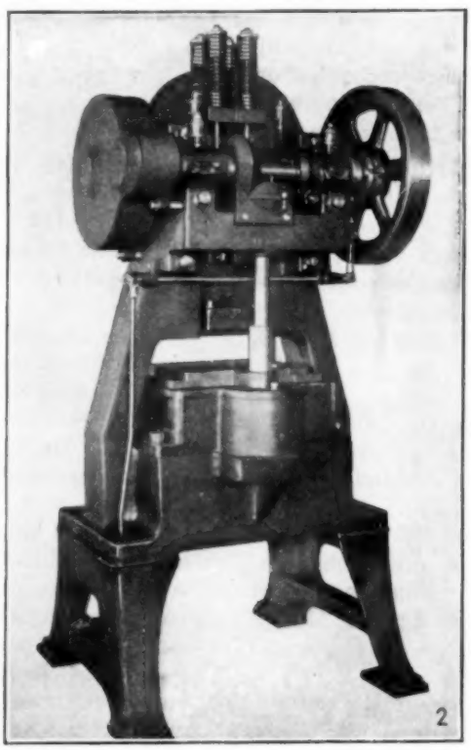
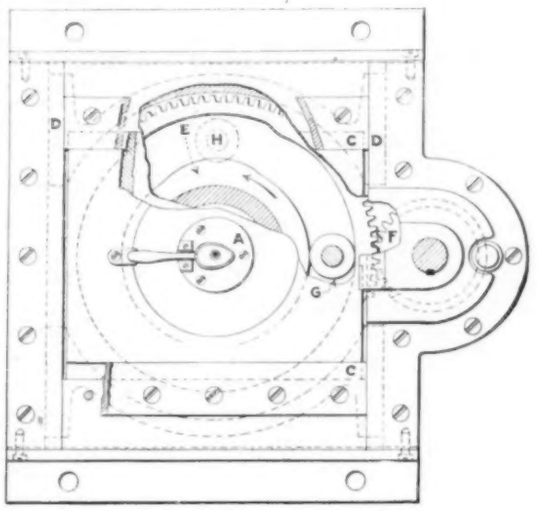
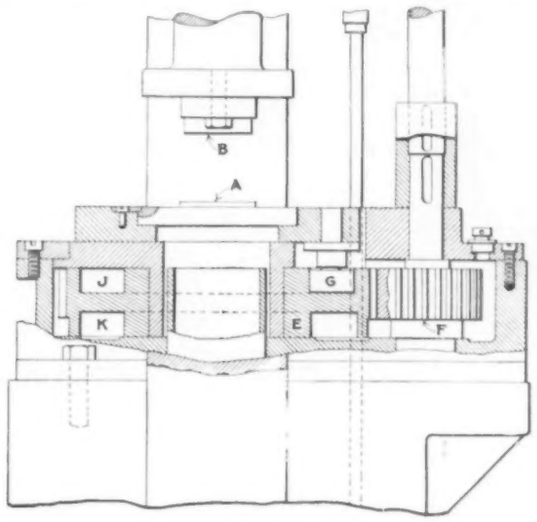


FIG. 2. REAR OF TRIMMING PRESS

ular lines are produced by a cam having two grooves, the ways *C* and *D* providing for the motion in the back-and-front and side-to-side directions respectively. The cam *E* is gear driven from the pinion *F* located on the vertical shaft receiving its motion from the main shaft of the machine, and is provided with two cam slots, one on the upper surface and the other on the lower surface. The cam roller *G*, which operates in the upper cam slot *J*, is fastened to a stud on the upper slide and imparts to this slide the forward and back motions. A second cam roller *H* moves in the slot *K* on the lower side and imparts the two crosswise motions to the holding die. It is easily seen that by changing the starting point of the geared wheel any one of the four shearing movements can be made to take place first, as best suits the outline of the shell being trimmed. In order to prevent any distortion of the stamping during the shearing operations a filler that may be made of babbitt or other such material is used. The filler may be either placed in each individual stamping by hand or it may be attached to the upper or cutting die, but in this case provision has to be made to allow it to slide on the under surface of the upper die to take care of the relative motion between the upper die and the holding die. The method of accomplishing this is shown in Fig. 4, which shows a die used for trimming a spoon. It will be noticed that two T-slots are cut in the filler at right angles to one another, allowing it to slide on the T-head bolt fastened to the upper die. It will be noticed that the T-slots open down through the under side of the filler. This is permissible because the main necessity is to hold the stamping near the edges to be sheared, the amount of bearing being determined somewhat by the thickness of the metal operated on.

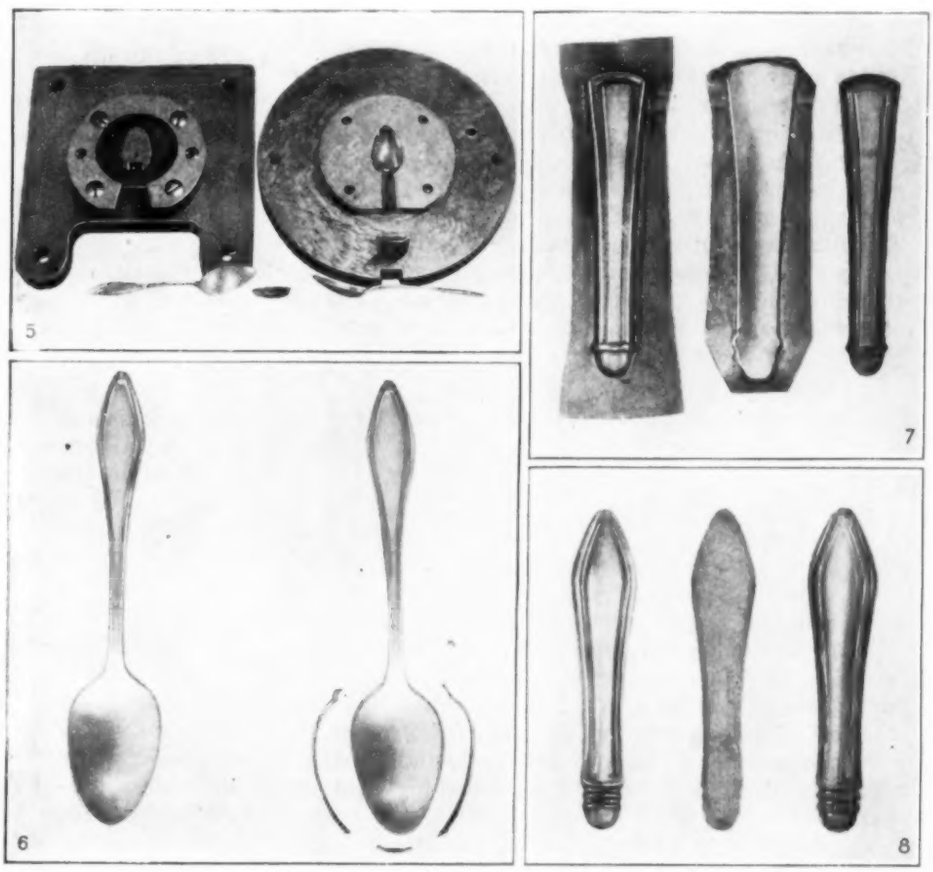


Plan



Front Elevation

FIG. 3. SECTION SHOWING THE METHOD AND MECHANISM USED FOR IMPARTING THE MOVEMENT TO THE HOLDING DIE



FIGS. 5 TO 8. SAMPLES OF WORK AND SOME OF THE TOOLS USED

Fig. 5—The dies for trimming a spoon. Fig. 6—A spoon before and after trimming, showing also the three pieces of scrap. Fig. 7—The stamping, scrap and finished part for half of a knife handle. Fig. 8—Another type of knife-handle half showing the back and front sides of the filler used

Fig. 5 shows a set of spoon dies which in this case is used with a filler that is placed in the spoon by hand. The die at the left is the upper, or cutting, die, while that at the right is the lower, or holding, die. It will be noticed that the portion of the upper die that does the cutting is recessed at the lower edge, this being necessary on account of the fact that the handle of the spoon must be left intact. The filler is shown in front between the two spoons. Fig. 6 shows a spoon before and after trimming, and also shows the three sections of scrap removed.

Fig. 7 shows the operations on one-half of a knife handle, the three pieces shown being the stamping as it

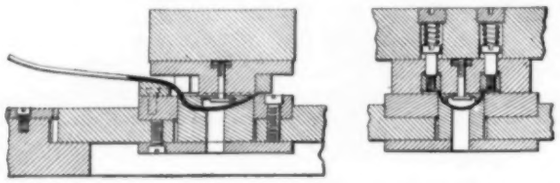


FIG. 4. METHOD OF ATTACHING THE FILLER TO THE SHEARING DIE

comes from the drawing press, the scrap removed by the trimming press and the finished piece after the trimming press has performed its operations. It will be noticed from the scrap that the dies in the forming press were made with a considerable radius on the corner of the female die and the trimming was done somewhat below in order not to encounter the rounded corner, or fillet, formed. It is claimed that this ability to form the original stamping somewhat deeper than necessary and then trim somewhat below the fillet avoids many of the troubles that were customary where it was necessary to make this fillet as small as possible on account of the former methods of trimming.

Fig. 8 shows half of a knife handle of another type after having been trimmed and also shows front and back views of the filler, which is made of babbitt metal. This filler is one of the type that is placed in the stamping by hand, a number being provided of course in order that they may be placed in the stampings while the shearing operation is being performed on the preceding piece.

Salesmanship Versus Engineering Horse Sense

By John R. Godfrey

There has been a lot of bunk written about the psychology of salesmanship; how you must look the prospective victim in the eye, size up his nose, the set of his ears and the height of his forehead and then apply rule 79 or whatever number fits his particular combination. And having argued and browbeaten him into buying something he didn't want the salesman repeats by way of inspiration the old gag to the effect that "Anyone can sell a man something he wants, but it takes a real salesman to sell him something he doesn't want."

Speaking solely from the machinery standpoint, although I haven't a doubt it applies elsewhere as well, this is the worst possible attitude for a salesman who ever expects a repeat order. It leaves a lasting antagonism and resentment in the mind of the victim, and not only the salesman but the manufacturer suffers also. And furthermore it is proof positive that the buyer didn't know his business.

Just suppose you have some automobile cylinders to machine. You know there are several ways to do it, and you will, if you are wise, consult both the reading and advertising columns of the *American Machinist* for information as to which method is best. Then you may send for circulars of those machines which seem likely and await the siege of salesmen which you know this will bring forth.

What you want is information and not salesmanship. And if salesmanship persuades you to buy the wrong machine, if Jones gets the order because he's a good fellow or you know his wife's sister, or he belongs to your lodge, you admit unknowingly that you are not on to your job. You really ought to know which machine is best and order it without bothering a salesman or having a salesman bother you.

If you need information about the different machines to decide which is best for your work, considering range of work, convenience, price, etc., the maker should be able to supply it easily. His engineers should know its various applications and give you clear and concise data on similar work to yours.

The engineers who handle such problems are being called sales engineers. But if they know when they are wise they will keep the engineering side uppermost. They should by all means give the prospective customer all the information possible as to what the machine will do and how it will handle his particular work. But when they go beyond this they are telling the customer how to run his own shop, and this is sometimes a ticklish operation.

It's one thing to make him see that your machine is best for his purpose, but it's quite a different proposition to tell him his notion of mechanics is all wrong, that he wants a vertical machine instead of a horizontal, or vice versa, when his judgment has decided on the other type. Give him good engineering advice if you will, but at least let him think he is deciding for himself.

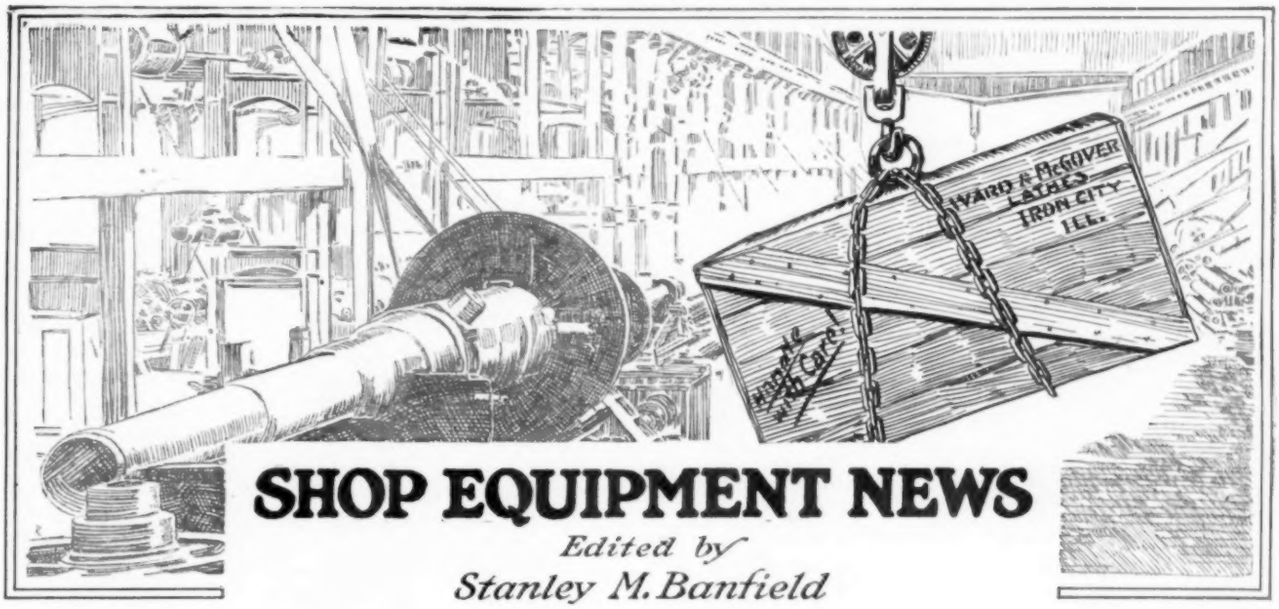
Cost per piece is what counts. If the sales engineer can guarantee a lower net cost than anyone else and back it up he ought to win. But hypnotism and any special brands of salesmanship ought not to count. Just plain horse sense coupled with sufficient information ought to do the trick. Don't ever try to sell a man something he doesn't want.

A Use for Broken and Worn-Out Drills

By Oscar Craft

Discarded drills of any size can be successfully used for end-milling and bottoming out keyways; in fact they may be used anywhere an end mill will serve. They will cut better than the regular end mills generally used. Grind the end same as a bottoming drill and relieve the spiral flutes of drill to a cutting edge.

The drills must be short and stubby. Round-shank drills I use in a taper sleeve with a straight-bored hole and slit in at least three places. An assortment of bushings cut in halves completes this equipment so that when the tapered sleeve is driven into the spindle it will grip the shank firmly.

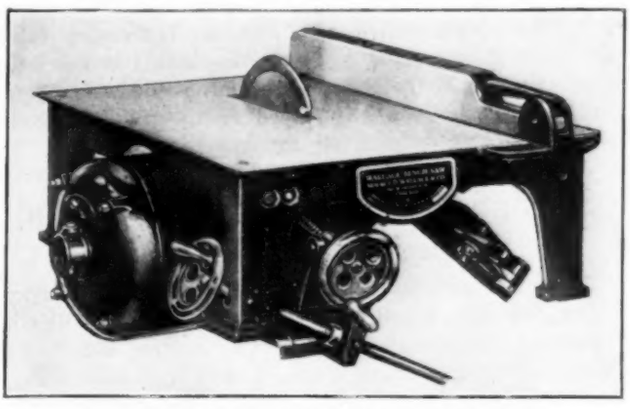


SHOP EQUIPMENT NEWS

Edited by
Stanley M. Banfield

Wallace Bench Saw

The motor-driven bench saw shown in the illustration has just been placed on the market by J. D. Wallace & Co., 1401 West Jackson Blvd., Chicago, Ill. The device is intended for light pattern, cabinet and carpenter work, and is operated by a ½-hp. electric motor that can be connected to the regular lighting circuit, the saw being portable in order that it may be moved to the most convenient position. The saw is particularly valuable where angular cuts have to be made, as it can be tilted to cut at the desired angle, which is claimed to be much more convenient than the usual

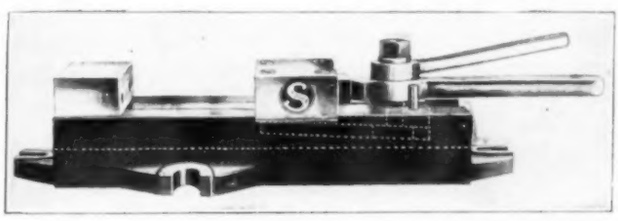


WALLACE PORTABLE BENCH SAW

method of tilting the table. The tilting mechanism is controlled by the handwheel at the left, which tilts the saw through a screw mechanism, giving an accurate adjustment to various angles as indicated on the graduated scale shown at the front of the machine. The saw is raised or lowered by means of a second handwheel which can be seen at the front. The cross-cut fence is built into the saw and is mounted on a rod located beneath the table, it being possible to swing the fence off the table when it is not needed. With the cross-cut fence set to an angle and the saw also tilted it is possible to cut at both angles in one operation, the operator working on a table, which is in a horizontal position, and the stock being guided by the rip fence. The saw is geared directly to the motor, which prevents any belt trouble or slippage, the motor swinging with the saw when this is tilted. The machine is shipped in a heavy frame standard that can be used as a saw bench after uncrating.

"Supreme" Quick-Action Vise

The Spafford Tool Works, 10 Hoadley Pl., Hartford, Conn., are now marketing the "Supreme" quick-action vise shown in the illustration. It is made for general machine-shop use on milling machines, grinding machines or for other uses where a quick-action vise is desirable, and in four sizes with jaw widths of 3, 4, 5 and 7 in. respectively. All steel parts are of drop-forgings or bar stock and are hardened and ground to size while the base is scraped to fit the slide. All



"SUPREME" QUICK-ACTION VISE

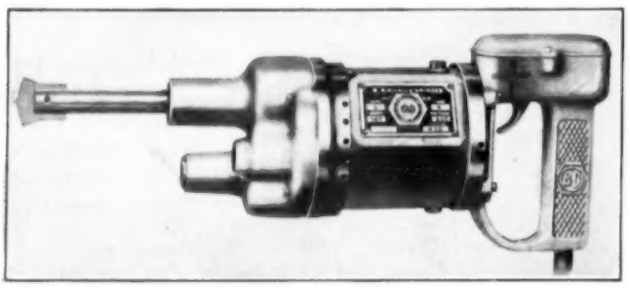
Made in four sizes, with 3, 4, 5 and 7-in. jaws and openings of 2⅝ in., 3⅝ in., 4¼ in. and 6¼ in. respectively; jaw heights of ⅞ in., 1¼ in., 1⅝ in. and 1⅞ in. and total heights of 2¼ in., 3⅛ in., 3⅞ in. and 4¼ in. respectively.

parts so far as possible are made to gages to insure interchangeability. A stationary jaw is let into a recess in the semisteel base in order to prevent it from changing position. The bolt holes for clamping the loose jaw to the stationary jaw are so located that they may be conveniently tightened without coming into contact with the bumper block. The pin which the cam lever works against in opening the vise is so located that when the vise is fully opened the lever slips past the pin, thus avoiding breaking the pin

or elongating the hole in the base. The hardened slide is smooth on the top without any serrations for dirt to get into, the levers being held in place by means of a bolt in a T-slot, the under side of which is made at an angle. The bolt head is also made at the same angle, thus giving it a wedge shape and preventing slippage in a backward direction. The sliding jaw is operated by a cam lever, which draws it tight against the work, while the eccentric lever gives the final tightening.

Black & Decker Electric Valve-Grinding Machine

The motor-driven, poppet-valve grinding machine shown in the illustration is being manufactured by the Black & Decker Manufacturing Co., 105-115 South Calvert St., Baltimore, Md. The construction is such that the spindle oscillates with a long, steady sweep similar to the movement obtained in grinding by hand, but much more rapidly, a pistol grip and trigger switch

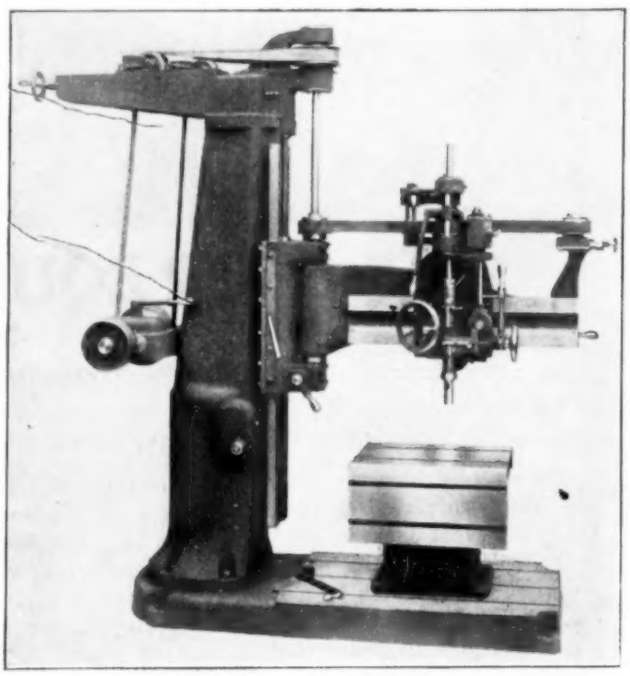


MOTOR-DRIVEN VALVE-GRINDING MACHINE

being incorporated to provide for convenience in operation and control. The motor is of ⅛ hp., air cooled, and operates on standard power circuits of 25 to 60 cycles alternating current or on direct current. It is made in voltages of 32, 110 and 220. The motor and gearing for the reciprocating motion are completely inclosed in an aluminum housing, the gearing being separated from the motor compartment and packed in grease. The grinding spindle has a ball thrust bearing, the armature shaft runs on Norma ball bearings and the gears are mounted on shafts ground to size and supported at both ends in long phosphor-bronze bushings. A number of bits are provided to make the tool adaptable to various types of valves.

"Avey" Radial Drilling Machine

The Cincinnati Pulley Machinery Co., Cincinnati, Ohio, is now marketing the "Avey" sensitive radial drilling machine shown in the illustration. The machine is ball bearing throughout and is said to incorporate a number of new and novel features that have not been previously employed in the design of sensitive radial drilling machines. It is regularly supplied with plain hand feed and tapping attachments, but power feed can be supplied if this is desired. The spindle has a vertical rack feed of 8 in., and is provided with a No. 2 Morse taper in nose, giving a drilling capacity up to $\frac{29}{32}$ in. The machine illustrated has a 2½-ft. arm and takes 48 in. under the spindle. Six spindle speeds are obtainable, three being obtained through the open belt running on cone pulleys and three additional ones through back gears on the countershaft of the machine. On the power-feed machine four rates of feed are provided by means of a gear box located conveniently on the side of the head. The work may be held either on the table or on the base of the machine, both of which are provided with T-slots, the table also having



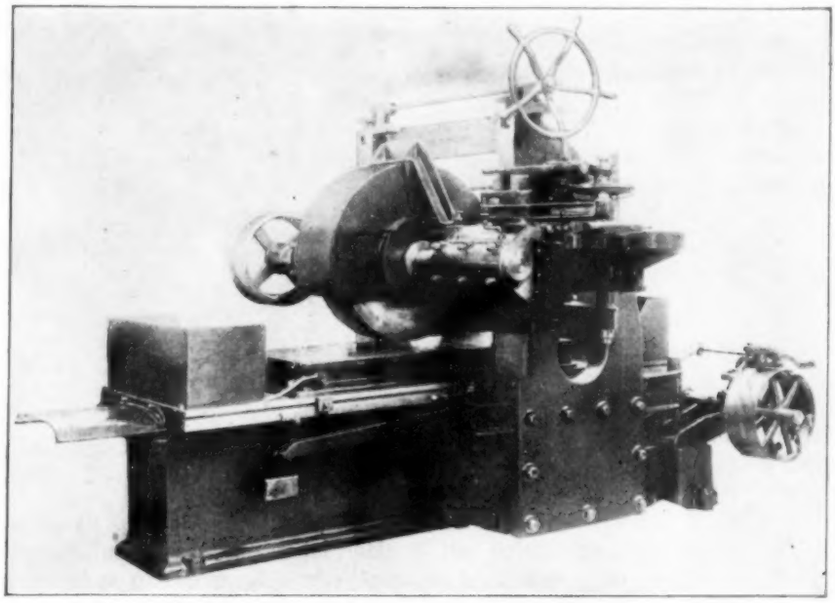
"AVEY" SENSITIVE RADIAL DRILLING MACHINE

Length of arm, 2½ ft.; distance from nose to spindle, 48 in.; spindle speeds, six, three with open belt and three with back gears on the countershaft; speeds on power feed machine, four, obtainable through gear box located on side of head; vertical feed of spindle, 8 in.; taper in spindle nose, No. 2 Morse.

a finished side supplied with T-slots. The arm is raised or lowered by means of a crank placed on the shaft projecting from the lower part of the column. A scale and adjustable stop are placed on a spindle sleeve to enable drilling to a fixed depth.

Springfield Heavy-Duty Oscillating Surface-Grinding Machine

The Springfield Manufacturing Co., Bridgeport, Conn., is now marketing the heavy-duty, oscillating, surface-grinding machine shown in the illustration. The particular machine shown is equipped with a regular sandstone for grinding steel lithographing plates, but it can be equipped with an emery wheel for other types of work if desired. The size of the wheel is 36 in. in diameter with 10-in. face, and the work is held on the machine shown by a large magnetic chuck. The machine is of substantial construction, the drive to the table being by means of bevel gears and a screw-reversing device the same as is customarily used on planing machines. The wheel and wheel spindle are carried in heavy and substantial slides fitted to the saddles on the faces of the uprights, and when the machine is in operation the wheel oscillates across the work as this passes under it. The oscillatory motion is accomplished by means of the crank and connection shown at the right side of the machine. The lever



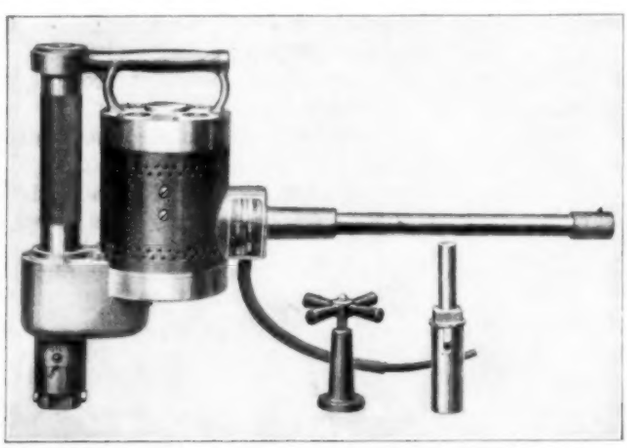
SPRINGFIELD HEAVY-DUTY SURFACE-GRINDING MACHINE

Size of wheel, 36 in. in diameter, with 10-in. face; capacity for work on table, 26 in. wide by 60 in. long; approximate weight, 13,000 pounds

just above the connecting-rod operates a clutch engaging the bevel gear which drives the oscillating motion, and this can be connected or disconnected at will, so that the wheel will travel in a straight path when doing the final finishing work. The table is inclosed with guards to take care of the splash, and will hold pieces up to 26 in. wide and 60 in. long. The weight of the complete machine is approximately 13,000 pounds.

McKay Bolt, Nut and Lag Screw Driver

The George C. McKay Co., 4247 Greenlee Ave., Cincinnati, Ohio, has just placed on the market the automatic nut, bolt and lag screw driver shown in the illustration. It is stated that the machine will drive nuts and bolts from $\frac{1}{4}$ to $\frac{7}{8}$ in. in diameter to a dead stop, meaning by this that they will be driven down as tight as they can be pulled with a 3-ft. hand wrench. The device is driven by an electric motor, the spindle running at 60 r.p.m. under full load. The total weight is 29 lb. and the motor is equipped with an automatic burn-out device that protects the motor against over-loading the machine beyond its capacity. The device is a part of the armature shaft and consists of a sliding clutch held in position by a spring. When any overload is applied to the machine, either by trying to make it do too heavy work or by any of the parts breaking, the clutch partly disengages, and in doing so strikes against a switch and shuts off the current in exactly the same manner as is done by pulling off the switch by hand. The device is wholly mechanical in action and it not dependent upon any electrical connections for its successful operation. After the device shuts off the current all that is necessary to start the machine again is to pull the switch out and then push it in. There are no fuses to be burned out. In using the device, when the nut is driven home the automatic device shuts off the current, thereby making unnecessary the judgment of the operator as to the time of shutting off the current. It is also claimed that the device is useful in tapping holes, spot facing, driving portable bars, reaming, line reaming, drilling, cutting threads and other such usages. The motor is reversed by merely turning the switch handle from left to right as required, making it possible to either drive or remove bolts and nuts.

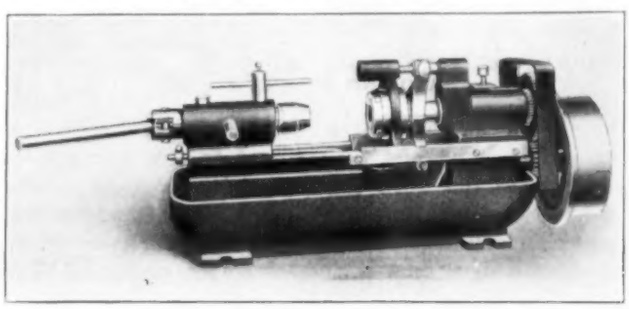


McKAY AUTOMATIC NUT, BOLT AND LAG SCREW DRIVER

Weight, 29 lb.; spindle speed under full load, 60 r.p.m.; bearings on armature and gears, S.K.F. ball type; thrust bearing on spindle, S.K.F.; spindle equipped with internal square, $1\frac{1}{4}$ in. and external square, $1\frac{1}{2}$ in.; height from tip of spindle to top of machine, 17 in.; total length to end of handle, 26 in.

Eastern Threading Machine

The threading machine shown in the illustration is being marketed by the Eastern Machine Screw Corporation, Truman and Barclay Sts., New Haven, Conn. The machine is designed for threading work which cannot readily be threaded on the automatic screw machine or such work as it is not desirable to thread on an automatic machine. It is equipped with a self-opening die head, and with a spring collet or expanding arbors for holding the work. The oil pump and countershaft are incorporated so that the machine is in reality a complete unit in itself. The work held in a collet is tightened by moving the lever on the end of the carriage. The work is then fed to the die head and when the desired length of thread has been cut the die head automatically opens and the carriage is moved

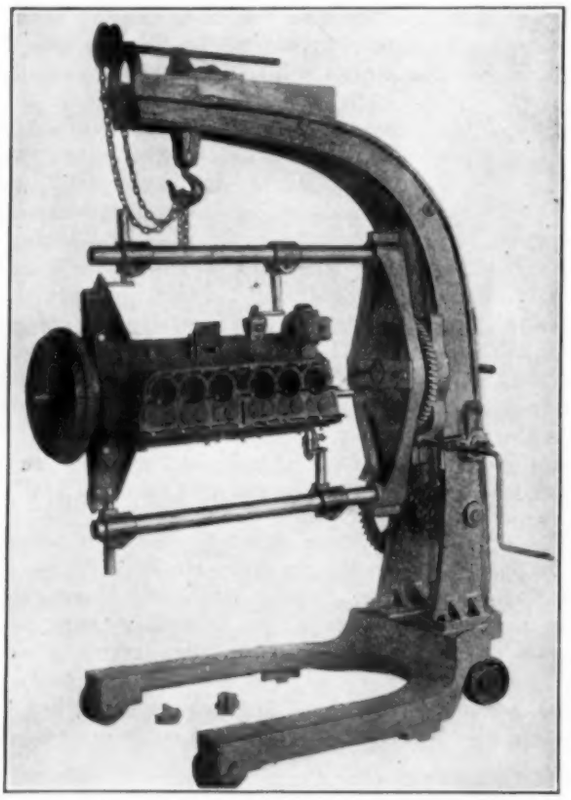


EASTERN THREADING MACHINE

back by hand. The length of thread cut is determined by the adjustable stop shown on top of the carriage. The present type is made in one size which will cut standard threads up to ¾ in. in diameter and fine threads up to 1 in. in diameter. The machine is intended to be placed on a bench and occupies very little space in comparison with other machines used for the same purpose.

Canton Floor Crane with Gasoline Engine Stand

The Canton Foundry and Machine Co., Canton, Ohio, has just placed on the market a portable floor crane and hoist shown, which is equipped with a special type of engine stand for the quick and economical handling of repair jobs on automobile engines. With this device



CANTON PORTABLE FLOOR CRANE WITH SPECIAL TYPE GASOLINE ENGINE STAND

the engine can be removed from the chassis, hooked on the motor stand and then moved to any part of the shop where the work can be most conveniently done. It is also possible to turn the motor into the best position to obtain the desired lighting. The hoist has a capacity of 2 tons with a clearance or lift of 6 ft. 2 in. The crane is equipped with Hyatt roller bearings.

International Thread-Gage Grinding Machine

The International Thread Gage Co., 100 W. 23d St., New York, has developed a simple and efficient grinding fixture for finishing thread gages. The machine is portable and can be used on a table or bench in whatever position desired. Power for driving the grinding

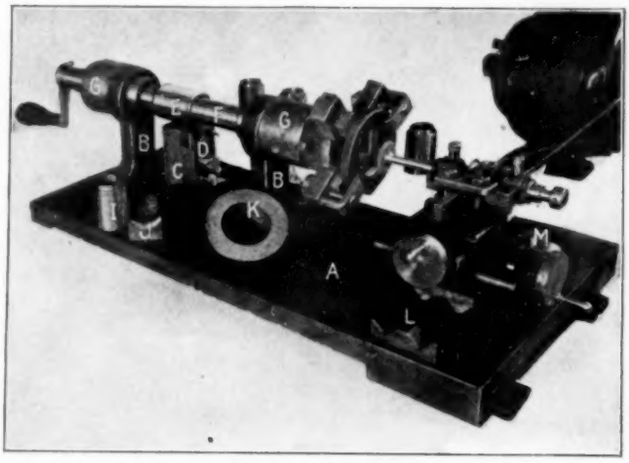


FIG. 1. GRINDING A RING THREAD GAGE

wheel is furnished by an independent motor of about ¼ hp., which can be attached to any convenient electric lamp socket. A machine, set up for grinding an internal gage, is shown in Fig. 1, while in Fig. 2 may be seen the same machine with chuck for holding an external gage. The only thing that is changed is the chuck.

In the following description like letters will refer to like parts as far as they can be made to apply. A base casting *A* has three brackets bolted to it, the two brackets *B* carrying hardened and ground steel bushings which form the bearings for the shaft. The bracket *C* carries a vertically adjustable member *D*, in the top of which is a clamp for holding the bronze nut which engages the master, or lead, screw *E*.

The slide *D* and the clamp are provided with wing nuts so that the master nut may be adjusted to a perfect bearing against its screw. The shaft *F* is a piece of mild steel carefully ground to a fit in the steel bushings. It is provided at one end with means for attaching chucks for holding different kinds of work, while at the other end a crank is shouldered onto the shaft and held by a taper pin lightly pressed into place with the fingers.

The master screw *E* is held to the shaft by four small headless setscrews, and to change from one to another it is necessary only to loosen these screws, take out the taper pin that holds the crank, and slide the shaft partly out of the machine toward the front.

On the outer end of each bearing bushing is threaded a dust cap *G* which protects the bearings from dust and abrasive. A removable cover *H* (shown only in Fig. 2) sits over the brackets and incloses everything between them when the machine is in use.

Master screws and nuts are provided for each pitch that the machine is intended to handle. One of each

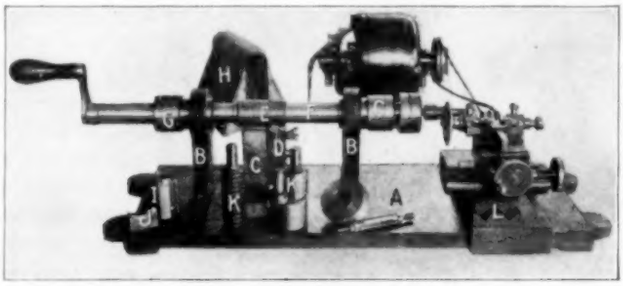


FIG. 2. GRINDING A PLUG THREAD GAGE

may be seen at *I* and *J* respectively. Samples of work are shown in each view at *K*.

At *L* a cast-iron block with a double V-groove in its upper surface is attached by screws and dowels to the bed, the axial line of the grooves being at a right angle to the center line of the shaft *F*. The wheel-carrying fixture is a standard slide rest regularly manufactured for the market by the Waltham Watch Tool Co., and is held in the grooved block by a bolt and strap *M* so that it is but the work of a second to change its position or remove it entirely. Means are provided to tilt the wheel arbor to an angle complementary to the helix angle of the thread to be ground.

For dressing the grinding wheel the slide rest is removed to the fixture shown in Fig. 3, for which the same bed and slide block are used but without the brackets. Instead a block *N* of steel, hardened and ground, is mounted on a suitable pedestal of cast iron, the whole being firmly attached to the base casting.

Two rectangular pieces of tool steel *O* are so mounted on block *N* as to swing on studs near the back end and are clamped in position by screws *P*. A $\frac{5}{16}$-in. standard plug *Q* fits in a hole at the front of the block. The exact relative position of the pivots on which the slideways *O* turn and the hole for the plug *Q* being known it is a simple matter to compute the angle from the sine which is measured with a micrometer over each slideway in turn and the central plug. The plug

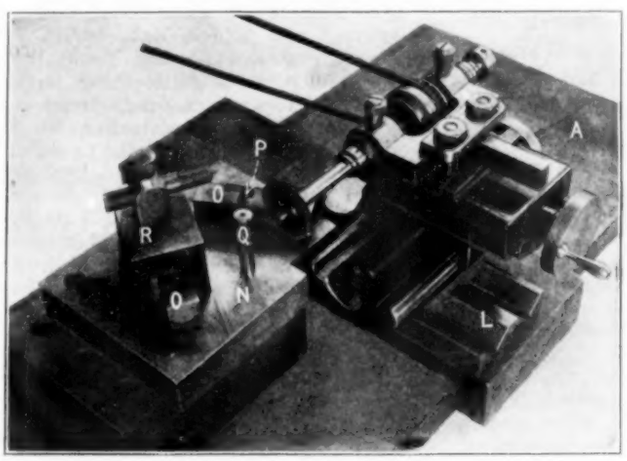


FIG. 3. DRESSING THE GRINDING WHEEL

is of course removed during the actual operation of dressing the wheel.

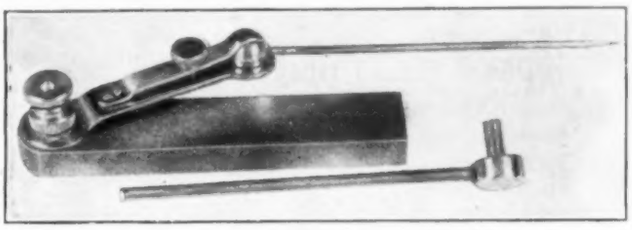
The slideways *O* are ground to parallelism and to known dimensions. The slide *R* carrying the diamond fits over the slideways *O*, and by turning it end for end it may be used on either side of the wheel without altering the set of the diamond. Adjustments of the wheel position are of course obtained by the movements of the slide rest.

Though any machine may be used for grinding any form of gage within its limits by changing its holding fixture and master screw the machines are so simple and comparatively inexpensive that it is good policy to keep one always set up to handle each kind of gage.

The machines are about 3 ft. long by 1 ft. wide and will stand 8 or 10 in. in height, not including the chuck used for holding large rings. Its weight is approximately 150 pounds.

Bush Universal Indicator

T. Daniel Bush, South Allentown, Penn., has just placed on the market the universal indicator, or wiggler, shown in the illustration. The device is adapted for use in any size of machine where work must be set



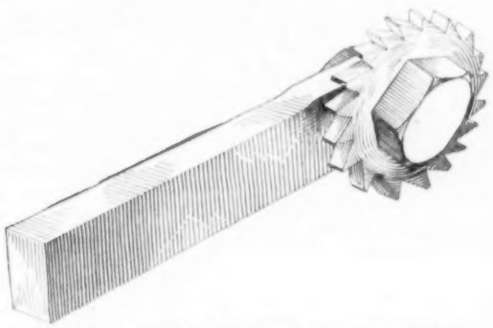
BUSH UNIVERSAL INDICATOR

up to given lines or layouts. The device consists of a base holding an arm which in turn holds the ball-headed needle. The arm is held to the base by means of spring tension adjusted by the knurled head screw at the left, while the tension on the ball head of the needle is controlled by the knurled head screw at the right of the arm; the needle being held by spring pressure will move before force enough to break it is applied. In case it is desired to use the device with a surface gage a rod is provided having a screw at its end, the entire device being substituted for the regular base. This attachment is shown in the foreground.

Milling Cutter for a Thread Tool

By A. A. Karcher

The sketch shows a toolholder in which an ordinary milling cutter is used for cutting threads. This design was prompted by having to cut an 8-pitch square thread to very close dimensions and accurate lead. Circular form tools are not practical owing to lack of side clear-



MILLING CUTTER FOR A THREAD TOOL

ance, and individual form tools are too expensive, as they have to be worked over and ground every time they are sharpened in order to maintain correct size.

This tool was first used for cutting an 8-pitch square thread for which we used a $\frac{1}{16}$-in. milling cutter. Since then it has been used to cut various sized square and acme threads. In a square thread you have only to find a milling cutter of the required thickness. In acme threads a cracked milling cutter or one with several teeth broken out can be circular ground to the required form and used.

This tool is comprised of but three parts, the holder, the screw, and the nut. After one tooth becomes dull the nut can be loosened and the next one turned up into position. In this way sharpening is avoided.

Sparks from the

The Airplane Will Become Peace-Time Utility

Engineer Loening Sees No Difficulty in Designing an Airplane That Will Travel 200 Miles an Hour

The war is hardly over and already progressively inclined minds are studying the feasibility of making the airplane a utility. Enough money and ingenuity have been spent on the war airplane during the last 10 years to make it a thoroughly reliable conveyance.

At the convention of the Society of Automobile Engineers, concluded in New York, Grover C. Loening, an aeronautical engineer of wide experience, undertook to answer the question of how airplanes can be used in peace time. He stated that during the war so much valuable experience has been accumulated that there is no reason why airplanes should not be introduced more generally. Airplanes can be made attractive to business men because they would be great time savers, especially in traveling distances exceeding about 60 miles.

Mr. Loening does not think that flying will soon become popular merely for the pleasure of flying, the comforts not being sufficiently attractive as yet. The noise of the exhaust of the engine and of the propeller are rather disagreeable, flying is not healthy for weak nerves, long trips are tedious and uncomfortable and the exhilaration expected is not realized. Exhaust, oil and cold rush of air are encountered and the seating space available is very scant.

Auto Preferred for Short Hauls

For hauls up to 60 miles the automobile will continue to have the preference because of its ability to stop at every curbstone. When it comes to greater distances the airplane has to compete with railroad train and boat. Since it is rather more expensive to use the airplane it must offer sufficient inducement in the way of speed, so as to cut down the traveling time in going from office door to office door. So long as landing fields are quite distant from office buildings an airplane trip would usually involve an automobile trip also, hence the distance from city to city should occupy little time.

In order to compete with train time Mr. Loening figures the airplane should be capable of developing a speed of 100 miles an hour, and if its speed is raised to 150 miles a complete trip will in many cases require but half as much time as when going by train. Thus, he says, a business man could leave his home in New York at 8 a.m., arriving in Washington at 10.30, leave Washington at 2 p.m. and arrive at his office at 4.30. Evidently the faster the airplane the more attractive and valuable will it be in the eyes of the man whose time is worth considerable money.

Mr. Loening says a three-seated monoplane tested at Dayton, Ohio, recently made 150 miles an hour. A European scout is reported to have made 160 miles, while a standard De Haviland four makes about 120 miles an hour.

Mr. Loening sees no great difficulties in designing a three-seated plane with a 400-hp. engine that will travel up to 200 miles an hour. He believes people will be willing to put up with considerable inconvenience just as they do in the New York subway, for example, to save time.

Why then should not the business man be willing to suffer some inconvenience in order to save an hour or more on a day's trip? Thus, it is argued that speed is the factor which will make the airplane a real utility.

The Coming Victory Loan

The Fifth, and possibly the last, of the loan drives, will begin on Apr. 6. No information as to the amount has yet been received, but it is rumored that it will be as large as any that has gone before.

America has demonstrated to the world that it can put across anything it undertakes, and when the Fifth loan drive is started it should be the passion of every real American to see it through to a successful finish.

* * *

Distributes Bonus on Salaries

The H. W. Johns-Manville Co., miner and manufacturer of asbestos and allied products, will distribute to all salaried employees, men and women, from heads of branches and departments to office boys, who have been in continuous service for the year 1918, an extra compensation of 20 per cent. on the salaries paid them during 1918. This extra compensation will cost the company approximately $1,000,000.

Aerial Service Is Planned from Australia to London

Prominent business men of Sydney, Melbourne and Adelaide, under the leadership of Reginald Lloyd or London, have formed a company with £10,000 ($48,665) paid-up capital for the purpose of developing an aerial route for mail and passenger service between Australia and London.

The purpose of the company is to explore the proposed route for landing sites, which are to be approximately 300 miles apart. The route is to be from Sydney or Melbourne direct to Port Darwin in northern Australia, from which point there will be a 300-mile sea trip across to the island of Timor in the Dutch East Indies, thence from island to island through Java and Sumatra to Singapore and Calcutta, across India to Karachi, thence to Bagdad and Port Said, from which point the choice of several developed aerial routes to London may be made.

In the near future Mr. Lloyd will lead a surveying party from Australia through the Dutch East Indies, the Malay States, India and Mesopotamia for the purpose of locating landing sites and to arrange for their lease or purchase. The organization of the present company is merely to provide for the expenses of this routeing party. After the completion of this survey it is proposed to finance a company in London to operate the aerial service to Australia which contemplates a complete journey in 150 hours between London and Sydney.

* * *

Locomotives and Cars Shipped During 1918

According to figures made public by Walker D. Hines, Director General of Railroads, there were 2622 locomotives shipped to railroads under federal control for the year ended Dec. 31, 1918. Of this number 744 were constructed under orders of the Railroad Administration, while 1410 were contracted for prior to the Government's operation of the transportation facilities.

In the total were 200 Russian decapods, constructed for the Russian government, but these were never delivered, the situation which arose in that country necessitating a change in plans.

For the calendar year 1918 there were 700 passenger cars delivered to class 1 railroads and for the same period there were 40,850 freight cars delivered. Of freight cars built during the year 15,250 were classified as standard Railroad Administration cars. Of the total number of freight cars delivered, 8663 were built in railroad shops.

World's Industrial Forge

By E.C.Porter
News Editor

Portable Shops Sent Abroad During the War

The Corps of Engineers purchased and shipped abroad three types of portable shops, each containing about 800 different tools and equipment and mounted on a 5½-ton truck. There were in all 95 of these portable shops.

The portable machine shop contains a work bench, drilling machine, portable electric drill, grinding machine, electric hammers, 14-in. lathe, power plant, switchboard and oxyacetylene-welding outfit with tools and supplies.

The portable blacksmith, plumbing and tin shop contains a work bench, forges, hoists, pipe-threading machines, shearing and punching machines, vises, welding and cutting outfit, power plant and switchboard, tools and supplies.

The portable carpenter shop contains boring machines, drilling machine, bench grinder, work bench, saw bench, double-purchase winch, power plant and switchboard, tools and supplies.

In addition there were 30 5½-ton material trucks, each containing 600 items of tools and supplies.

The complete machine shop costs about $9500, the carpenter shop $8500 and the blacksmith shop and material truck $8000 each.

* * *

Russia in Need of Agricultural Machinery and Implements

The value of foreign machinery and implements imported by Russia in 1911 was approximately 50,000,000 rubles. More than half of this amount was imported from the United States. The trade in machinery up to that year had been showing a steady rise.

At present the imports of machinery consist of reapers, binders, mowers, hayrakes, drills and plows. Russia is in need not only of these but also of all other varieties of agricultural machinery and implements. A ready market may be found among the farmers of Siberia for the following implements and machinery: Small kerosene and crude-oil tractors and engines, portable outfits of 2 to 10 hp. barn threshers of small capacity, burr-stone mills, farm wagons, cream separators, pumps, etc. Sales may be augmented through cooperative and commercial distributing channels and the coöperative farmers' associations.

What is proposed is to establish showrooms in Vladivostok for the display of American agricultural machinery and implements, where types of American machinery and implements may be displayed and demonstrated before customers, official experts, special commissions and all interested persons. The exposition and demonstration of American machinery and implements that are particularly adapted to the needs of this country would open a field of business the extent of which it is impossible even to approximate at this time. Almost daily inquiries are received from the remotest regions of this country requesting information as to where various kinds of American machinery may be inspected. So great is the interest that representatives of the farmers' coöperative association throughout Siberia visit Vladivostok with the expectation and hope of finding and having demonstrated American machinery and implements. The only thing that can be done at present is to supply catalogs, which it can be readily seen rarely answer the purpose of a purchaser.

The Russo-American Committee will coöperate in every way to assist the American manufacturers in introducing into Siberia American agricultural machinery and implements and *Russian Pacific Trade Expansion* will lend its columns for advertising.

Who Am I?

I am more powerful than the combined armies of the universe.

I have destroyed more men than all the wars of the world.

I am more deadly than bullets, and I have wrecked more homes than the mightiest of siege guns.

I spare no one, and find my victims among the rich and poor alike; the young and old; the strong and the weak. Widows and orphans know me.

I loom up to such proportions that I cast my shadow over every field of labor, from the turning of the grindstone to the moving of every train.

I massacre thousands upon thousands of wage-earners in a year.

I lurk in unseen places, and do most of my work silently.

You are warned against me, but you heed not.

I am relentless. I am everywhere; in the home, on the street, in the factory, at railroad crossings and on the sea.

I bring sickness, degradation and death, and yet few seek to avoid me.

I destroy, crush or maim. I give nothing but take all.

I am your worst enemy.

I AM CARELESSNESS!

* * *

Metal Trades Convention to Be in New York

The National Metal Trades Association will hold its 21st annual convention at the Hotel Astor, New York, on Apr. 23-24. The annual alumni dinner, the meetings of the executive committee and of the administrative council will be on Apr. 21. The gathering of the secretaries and the joint meeting of the branch presidents, secretaries and administrative councils will be held on Apr. 22.

Form Material-Handling Association

Technical Studies to Be a Leading Activity—Port and Terminal Problems to Receive Particular Attention

Following the suggestion of the Department of Commerce and the United States Shipping Board an association of manufacturers of machinery for handling materials has been formed and offices have been opened at 35 West 39th St., New York. The suggestion was made by the two Government agencies because of the need for intensive study of freight-handling methods at railroad and ocean terminals. By mobilizing the experience and ability of all manufacturers of handling devices in a single organization the Government will not only be able to reach this industry in an effective way when it needs coöperation, but the industry itself can more effectively attack the large and difficult problems presented at terminals and ports.

In general the lines of work—technical, educational, promotional, etc.—will parallel those of other trade associations, but the nature of the problems will require more extensive technical committee work than is customary in such bodies.

The active conduct of the association's work will be in the hands of Zenas W. Carter as secretary and manager. Mr. Carter was formerly commissioner of the Associated Metal Lath Manufacturers and previously field secretary of the Granite Paving Block Manufacturers' Association.

The following companies have come together in the work of forming the organization and are now constituting themselves a membership committee to complete the charter membership of the association: Watson Elevator Co., Edward F. Terry Manufacturing Co., International Conveyor Corporation, Rownson, Drew & Clydesdale, Inc., New Jersey Foundry and Machine Co., Hayward Company, Elwell-Parker Electric Co., Sprague Electric Works, Otis Elevator Co., Manning, Maxwell & Moore, Inc., Robins Conveying Belt Co., Michener Stowage Co., New York; Shepard Electric Crane and Hoist Co., Montour Falls, N. Y.; Brown Portable Conveying Machinery Co., Chicago; Karry-Lode Industrial Truck Co., Long Island City, N. Y.; Whiting Foundry Equipment Co., Harvey, Ill.; Wellman-Seaver-Morgan Co., Cleveland, Ohio; Alliance Machine Co., Alliance, Ohio; Alfred Box & Co., Inc., Philadelphia, Penn.; Meade-Morrison Manufacturing Co., East Boston, Mass.; Alvey-Ferguson Co., Cincinnati, Ohio; Heyl & Patterson, Inc., Pittsburgh, Penn.; American Hoist and Derrick Co., St. Paul, Minn.; Cleveland Crane and Engineer-

ing Co., Wickliffe, Ohio; Clyde Iron Works, Duluth, Minn.; Ohio Locomotive Crane Co., Bucyrus, Ohio; Northern Engineering Co., Detroit, Mich.; Electric Controller and Manufacturing Co., Cleveland, Ohio.

* * *

Cranes and Hoisting Engines Developed for War Work

Seven hundred cranes, mostly of the locomotive type, and 886 hoisting engines of various types and sizes were purchased for the use of the Engineer Corps at a cost of $4,996,000. About two-thirds of this equipment was sent to France and used in unloading materials at the ports of debarkation and on wrecking cars and trucks. The remainder was used in loading materials at ports of embarkation in this country. Without the use of these cranes the rapid shipment of materials and troops to France and the speedy release of vessels for the return trip could not have been accomplished.

The use of the larger cranes, which were developed for this special service and used both in this country and in France, permitted the loading and unloading of 97-ton consolidation locomotives completely assembled. thus avoiding the delay in putting them in service which would have resulted from shipping the separate parts and having them assembled on the other side.

* * *

New Opportunities for Men Disabled by War Service

The gates of hope are open for young men who seem to be hopelessly handicapped by the loss of limbs or other disabilities. Veterans of this war will not be social cripples and dependent pensioners, but rehabilitated, self-reliant and self-respecting men. That was the purpose of the framers of the vocational rehabilitation act passed by Congress last June and carried into effect by a Government agency, the Federal Board for Vocational education at Washington.

Every man discharged from the Army or the Navy should know of the opportunities offered him. Friends should point out to him that if he is entitled to compensation from the Bureau of War Risk Insurance, he is entitled also to the services of the Federal Board for Vocational Education. The board will assist him in finding suitable employment.

While he is in training his family continues to receive the usual allotment, his tuition and other expenses incident to his training are paid and he is given at least $65 a month for subsistence. If his last month's pay was more than that amount he may receive an amount equal to it. When he has finished his training course a job is ready and waiting for him probably, due to his newly acquired skill, at higher wages than he ever before earned. His compensation from the War Risk Insurance Bureau is in no way affected by what he may or may not earn.

American Gasoline Saved the Allies in Crisis

Deliveries at the Front Alone Prevented Change in Campaign, Official Documents Show

How deliveries of American gasoline in quantities on the western front alone prevented alterations in the plan of campaign which forced the Central Powers to an armistice is revealed in official documents made public by the United States Fuel Administration.

Less than 60 days before the armistice was signed, it was disclosed, the

situation hung in the balance—just when the American people were accustoming themselves to their voluntary relinquishment of Sunday automobile rides, and the observation of "gasolineless Sundays."

But for this and other sacrifices and the stimulation and direction of production what might have happened was indicated in a blunt cablegram from Marshal Foch saying simply:

"If you don't keep up your petroleum system we shall lose the war."

A still more serious cable was received Oct. 1. It said in part:

"Senator Berenger writes: 'Highest command informs him that position has become so serious that change in military operations will have to be contemplated unless increased deliveries gasoline at front are made possible.'"

UNITED STATES FURNISHED 80 PER CENT.

Eighty per cent. of the allied requirements of petroleum products, the Earl of Curzon pointed out in a statement made Nov. 21, was furnished by the United States, and Walter H. Long, British Secretary of State for the Colonies, sent special thanks for the work of the fuel administration in providing oil and for the activities of the American oil industry.

Of this fuel, of which the American people supplied four-fifths, Senator Berenger declared: "Petroleum will have played as great a part in the victory as blood itself, and will have proved the life blood of victory," and Sir John Cadman, British petroleum executive, used identical words, writing: "Oil fuel was the life blood of the navy."

Appreciations of America's splendid and successful efforts to provide this "lifeblood" on land and sea also were received from E. D. Hewan, oil executive of the British Ministry of Shipping; Camillo Ceruti, of the Italian military mission, and other high officials among the allies.

The shipment of gasoline and other petroleum products so promptly and in such large quantities was made possible only by the patriotic efforts of the petroleum industry working through the National Petroleum War Service Committee in harmonious coöperation with the Fuel Administration.

* * *

Civilians Wanted to Teach Trades to Disabled Soldiers

The employment of additional civilians to teach trades and manual arts in the reconstruction wards and shops of Army hospitals at $50 a month, with quarters and subsistence provided, or $62.50 a month additional in lieu of quarters and subsistence is authorized by Surg.-Gen. M. W. Ireland.

Considerable difficulty has been met with in obtaining a sufficient number of instructors for the hospitals, and the Surgeon General has directed that every effort be made to find officers or enlisted men qualified to teach. These may either be transferred to the Medical Department and remain in the service, or, without transfer, be assigned to such duty.

Teachers of the following subjects are needed: Ordinary school subjects; agriculture, market gardening; carpentering; cabinet-making; motor mechanics; patternmaking; gas engineering; shorthand; typewriting; stenotyping; drafting; telegraphy; printing; shoe repairing; mechanical engineering; machine work; electrical work; leather work; sign painting; and physical education. Experienced vocational advisers are also required.

* * *

German Writer Praises American Machine Tools

In his analysis of the machine-tool industry in Germany Walter Waldschmidt writing in the Berlin *Börsen-Courier* pays tribute to the quality of American tools and expresses some anxiety concerning the ability of Germany to successfully compete in this field after the war. Throughout his discussion Mr. Waldschmidt speaks of machine tools when he often means not only the tools but also the special machines necessary for their manufacture.

According to him, when in 1890 the rapid industrial development of Germany had caused a heavy demand for tool-making machinery, it was apparent that the United States manufactured the best machines and the best machine tools. In fact, said he, "American superiority was then so great that I doubted whether Germany could complete with any success. Machine tools are one of the best, if not the best, of America's products."

Personals

CHARLES D. ELLIS, who has been with the Hart-Parr Co., Charles City, Iowa, for the past 15 years, has been elected president to succeed A. E. Ellis, deceased.

H. H. HENRY, president of the Dart Truck and Tractor Corporation, Waterloo, Iowa, has become vice president and general manager of the Maxim Munitions Corporation, New York.

THEODORE R. HERMANSON, formerly with the Harrison Works of the Worthington Machinery Corporation, has become works manager of the Epping-Carpenter Pump Co., Pittsburgh, Penn.

EDWARD W. DODGE, for many years connected with the Norton Co., Worcester, Mass., as sales manager, has been made general sales and works manager of the Star Corundum Wheel Co., Detroit, Mich.

GUSTAVE HUETTE, Sheboygan, Wis., founder and for many years president of the Falls Machine Co., now the Falls Motors Corporation, Sheboygan Falls, Wis., has disposed of his final holdings in the company and will retire.

W. H. RAISBECK of H. Boker & Co., Inc., New York, has opened a sales office at 447 Book Building, Detroit, Mich., and expects to open a new warehouse in that city, carrying a complete stock of tool steels and specialties.

LESTER E. ARMSTRONG has accepted a position as advisory engineer with the Powdered Coal Engineering and Equipment Co., Chicago. Prior to his service in the air branch of the Army Mr. Armstrong was associated with the Babcock & Wilcox Company.

A. C. OLFS, formerly Eastern representative of the Titanium Bronze Co., has been appointed Michigan representative for the Stewart Manufacturing Corporation, Chicago, maker of die castings. A sales office has been opened at 1509 Kresge Building, Detroit.

A. H. WILLEY, Reliance Steel and Tool Co., New York, plans to sail on Feb. 19 for a few months' trip to Great Britain, France, Spain, Italy, Holland, Belgium and Scandinavia. He is planning to establish reciprocal trade relations, involving thus both import and export business.

B. F. GEYER, formerly general sales manager of the Wayne Oil Tank and Pump Co., Fort Wayne, Ind., has been elected vice president and general manager of that company. E. J. GALLMEYER, formerly manager of the Memphis district, assumes the duties of general sales manager.

EDWARD A. MILLER has been made assistant superintendent of the Jersey City plant of the Metal and Thermit Corporation, New York. Some of Mr. Miller's former connections have been with the Essex Foundry, Newark; Pioneer Iron Works, Brooklyn; Standard Aniline Products, Inc., Wappingers Falls, N. Y., and the National Conduit and Cable Co., Inc., Hastings-on-Hudson, N. Y.

ALFRED H. BARTSCH, for more than seven years advertising manager of the Bosch Magneto Co., and more recently representing several firms in the automotive industries in Philadelphia as merchandising and advertising counsel, has joined the staff of the American Bosch Magneto Corporation as general sales and advertising manager.

W. F. ROBERTS, general manager of the Sparrows Point, Md., plant of the Bethlehem Steel Co., and HOLDEN A. EVANS, president of the Baltimore Dry Docks and Shipbuilding Co., Baltimore, are among the members of the board of directors of the Export and Import Board of Trade recently formed for the purpose of increasing foreign trade at Baltimore.

Obituary

GEORGE K. GARVIN, president of the Garvin Machine Co., Spring and Varick Sts., New York, died at his home in Garden City, Long Island, on Thursday, Feb. 20. Mr. Garvin was 60 years old. Further particulars of his death will appear in next week's issue.

ALBERT M. CRANE, well known in the iron and steel industry, died recently of pneumonia. He had been ill only three days. For years he was general sales manager of the Illinois Steel Co., later becoming chairman of the executive committee of the American Steel and Wire Co.

New Publications

Steam Engines. By E. M. Shealy. Two hundred and ninety 6 x 9-in. pages; 173 illustrations; bound in green cloth boards. Published by the McGraw-Hill Book Co., 239 West 39th St., New York. Price, $2.50.

This book on steam engines was written to be used as a textbook for correspondence students in the University of Wisconsin Extension Division. It is the third of a series of three textbooks designed for students who are pursuing a general course in steam engineering, the other two books being "Steam Boilers" and "Heat." In this course the aim is to teach the fundamental principles underlying the operation of the steam engine and to do this in as simple and nonmathematical a manner as possible. This is particularly true of those parts which deal with thermodynamic principles. Enough of the practical features of steam-engine operation is given to illustrate the principles, and operating engineers who may take this course will be able to supplement from their own experience other applications of the principles presented. The part of the book dealing with valve gears has been made more complete than other sections because the experience of the author shows that operating engineers as a rule do not understand the valve-gear mechanism of their engines as well as they do other parts.

The different chapter headings are: Principles of the Steam Engine; Corliss and other Engines; Parts of the Steam Engine; Heat, Work and Pressure; Properties of Steam; Indicators; Indicated and Brake Horsepower; Action of Steam in the Cylinder; Steam Engine Testing; The Slide Valve; The Valve Diagram; Valve Setting; Shifting Eccentric and Meyer Valve; Reversing Mechanisms; Corliss Valve Gears; Governing; Compound Engines; Condensing Apparatus; Lubrication; Steam Turbines.

Business Items

The Merchant Calculating Machine Co., San Francisco, has moved its Eastern sales office from Philadelphia to Chicago, Ill.

The Carrie Gyroscopic Corporation, formerly of 216 William St., New York, has moved to larger quarters at 62 West 14th St., New York.

At the annual meeting of the stockholders of the Peck & Young Manufacturing Co., New Britain, Conn., held recently in Forestville the old board of directors was reëlected as follows: A. W. Bowman, J. M. Carney and S. M. Stone of Hartford; W. E. Fogg, of Bristol; I. D. Russell and W. L. Humason of New Britain, and L. C. Humason of Farmington.

The directors of the Traut & Hine Manufacturing Co., New Britain, at the annual meeting of the stockholders recently elected the following officers: President and treasurer, George W. Traut; vice president, Frank L. Traut; secretary, Henry E. Hine; general superintendent, Ernest N. Humphrey. Henry S. Walter is also a member of the board of directors reëlected.

Edward R. Ladew Co., manufacturer of Ladew leather belting, with factory and general offices at Glen Cove, N. Y., announces important changes in its Southern organization made with a view to more active efforts in the South. O. S. Horton has been appointed manager of the Southern branch with headquarters at Charlotte, N. C., and territory covering all states south of Maryland, West Virginia, Kentucky and Arkansas west to Texas. Walter Carr, formerly of the New York office, is assistant branch manager. Several new salesmen have been added to the organization, and a large stock of Ladew belting will be carried at the Charlotte office and disposed of through distributers located in this territory.

Several important changes were made at the annual meeting of the directors of the Stanley Works, New Britain, Conn., which succeeded the annual meeting of the stockholders of the concern held recently. These changes embrace the naming of Walter H. Hart as second vice president, Ernest W. Christ as secretary, and Patrick F. King as assistant secretary. The stockholders elected the following directors: William H. Hart, L. Hoyt Pease, George P. Hart, E. N. Stanley, E. A. Moore, F. G. Platt, C. F. Bennett, F. S. Chamberlain and A. W. Stanley. The directors at a subsequent meeting recently elected the following officers: Chairman of the board of directors, George P. Hart; president, E. Allen Moore; first vice president, C. F. Bennett; second vice president, Walter H. Hart; treasurer, L. Hoyt Pease; secretary, Ernest W. Christ; assistant treasurer, L. W. Young; assistant secretary, P. F. King.

The Weekly Price Guide of

IRON AND STEEL

PIG IRON

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$34.60	$37.60
Northern Basic	31.80	34.80
Southern Ohio No. 2	32.80	35.80
NEW YORK, Tidewater delivery		
Penna. 2X	36.15	39.55
Southern No. 2 (silicon 2.25 to 2.75)	39.95	41.70
BIRMINGHAM		
No. 2 Foundry	31.00	34.00
PHILADELPHIA		
Eastern Pa. 2X	36.15*	39.15*
Virginia No. 2	35.10†	40.50†
Basic	33.90*	36.90*
Grey Forge	33.90*	36.90*
Bessemer	.....	39.10*
CHICAGO		
No. 2 Foundry Local	31.00	34.50
No. 2 Foundry Southern	37.25	39.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	31.00	35.40
Basic	30.00	34.40
Bessemer	33.60	36.60

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.07	$4.07	$4.20	$3.97	$4–4.04	$4.07	$4.20
Soft steel bars	3.97	3.97	4.10	4.07	4–4.04	3.97	4.10
Soft steel bar shapes	3.97	3.97	4.10	4.07	4.14	3.97	4.10
Soft steel bands	4.57	4.57	.....	.....	.....	.....	.....
Plates, ¼ to 1 in. thick	4.27	4.27	4.45	4.47*	4.39	4.27	4.45

* For ⅜-in. plates the extra is 30c. per 100 lb.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill	$3.50	$3.50
Warehouse, New York	4.75	4.70
Warehouse, Cleveland	3.99	3.98½
Warehouse, Chicago	4.10	4.10

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	Pittsburgh, Mill, in Carloads	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
*No. 28 black	4.70	6.22	6.22	6.445	5.75	6.45	6.22	6.445
*No. 26 black	4.60	6.12	6.12	6.35	5.65	6.35	6.12	6.35
*Nos. 22 and 24 black	4.55	6.07	6.07	6.295	5.60	6.30	6.07	6.295
Nos. 18 and 20 black	4.50	6.02	6.02	6.245	5.50	6.25	6.02	6.245
No. 16 blue annealed	4.10	5.37	5.37	5.645	4.95	5.65	5.37	5.645
No. 14 blue annealed	4.00	5.27	5.27	5.545	4.85	5.55	5.27	5.545
No. 10 blue annealed	3.90	5.17	5.17	5.445	4.75	5.45	5.17	5.445
*No. 28 galvanized	6.05	7.57	7.57	7.695	7.15	7.70	7.57	7.695
*No. 26 galvanized	5.75	7.27	7.27	7.395	6.85	7.40	7.27	7.395
No. 24 galvanized	5.60	7.12	7.12	7.245	6.70	7.25	7.12	7.245

* For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List plus 9%	List plus 25%
Cleveland	List plus 7%	List plus 10%
Chicago	List plus 9%	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	35%	40%
Cleveland	35%	40%
Chicago	35%	40%

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$25.50–30	$15.00
Cleveland	20.00	15.30
Chicago	16.50	15.00

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
1/2, 11/32, 5/16, 1/4, 7/32, 3/16 No. 8, 5/32 and No. 10 1/8 No. 12 3/32, No. 14 and 1/16 No. 18 No. 20	25.50 to 33.00	5/16 by 12 in. long	14.00
		1/4 by 19 in. long	12.00
		3/16 by 19 in. long	10.00
		1/4 by 21 in. long	10.00
		Special Welding Wire, Coated	
		1/4	33.00
		5/32	30.00
		1/16	38.00

Domestic 20c. for 1/16, 15c. for 1/8 to 5/16.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.50	8.00	7.50
Spring steel (light)	10.00	11.25	11.75
Coppered bessemer rods	8.00	8.00	7.07
Hoop steel	4.57	4.75	4.77
Cold-rolled strip steel	8.02	8.25	8.57
Floor plates	6.27	6.00	6.25

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh: basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's Co. for iron, both dated Jan. 1, 1919.

BUTT WELD

Steel Inches	Black	Galvanized	Iron Inches	Black	Galvanized
1/8, 1/4, and 3/8	47%	20½%	3/8 to 1¼	36%	20%
1/2	51%	36½%			
3/4 to 3	54%	40½%			

LAP WELD

2	47%	34½%	2	29%	15%
2½ to 6	50%	37½%	2½ to 6	31%	18%

BUTT WELD, EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	43%	25½%	3/8 to 1¼	36%	21%
1/2	48%	35½%			
3/4 to 1¼	52%	39½%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45%	33½%	2	30%	17%
2½ to 4	48%	36½%	2½ to 4	32%	20%
4½ to 6	47%	35½%	4½ to 6	31%	19%

Stock discounts in cities named are as follows:

	New York Black	New York Galvanized	Cleveland Black	Cleveland Galvanized	Chicago Black	Chicago Galvanized
⅜ to 3 in. steel butt welded	43%	27%	43%	26%	44.9%	29.9%
3½ to 6 in. steel lap welded	38%	23%	39%	23%	40.9%	26.9%

Malleable fittings. Class B and C, from New York stock sell at list +12½%. Cast iron, standard sizes, 10% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	17.00	20.50	23.50
Tin in 5-ton lots	72.50	72.00	85.00
Lead	5.10	5.75	7.00
Spelter	6.85	7.85	8.00
ST. LOUIS			
Lead	4.80	5.45	6.85
Spelter	6.50	7.50	7.75

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Copper sheets, base	24.50–27	29.00	31.50–33	30.00	32.50	32.00	36.00
Copper wire (carload lots)	25.00–28	28.00	32.00	32.00	28.50	28.50	34.50
Brass sheets	23.75–28	29.00	30.75	32.00	29.00	29.00	35.50
Brass pipe	34.00–37	37.00	36.50	36.00	35.50	37.00	41.50
Solder (half and half) (case lots)	38.00–41	41.00	62.00	41.50	47.00	39.00	48.75

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse: 25% to be added to mill prices for extras; 50% to be added to warehouse price for extras:

	Current	One Year Ago
Mill	$20.50	$25.25
New York	21.50	26.25
Cleveland	27.00	30.00
Chicago	28.50	37.00